



DISCOVERY

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Notes of the Month

THIS month Professor Julian Huxley contributes to our symposium on Science and Religion. We believe that most readers will dissent from his conclusion that God is a human product "arising inevitably from a certain kind of ignorance and . . . helplessness with regard to man's external environment." He makes this statement as if it were a matter of fact instead of being merely an assumption; and although theologians are frequently dogmatic on matters which likewise belong to the realm of opinion, this does not justify the same error on the part of other thinkers. Professor Huxley gives us a lucid analysis of religion as a human characteristic and its manifestations throughout history. He shows how religion has evolved and how many of the practices at one time regarded as religious are now seen to have been merely superstitious. But to argue from this that all religion which acknowledges a Higher Power than man is a superstition is not only unwarranted on scientific grounds, but reflects a prejudiced attitude on a matter which from its very nature requires at least an open mind. The discoveries of science have merely increased the sense of mystery which envelops the mind of anyone who thinks at all deeply on the meaning and destiny of life. Belief in God, far from being prompted by "helplessness," more often reflects a feeling of triumph and exultation. We are glad to print the views of our distinguished contributor, but we would not have any

reader of *Discovery* think that we endorse his conclusions on this vital question.

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While discussing this matter we may draw attention to another article, by Professor T. E. Gregory, which deals with the place of the expert in modern life. There is a natural tendency in these days of specialization to "leave it to the experts to decide," whereas the more one knows about a particular subject, the less inclined one is to adopt one solution rather than another. Yet the world is a complicated place; there are terrific problems to be solved, and if the expert cannot solve them, who can? In answering this question Professor Gregory points out that it is of the utmost importance to remember that all science deals not with ends, but with means. The expert can perhaps tell us the best way of arriving at a particular result, but whether the result is worth having is a matter about which he is not necessarily more competent to judge than the man in the street.

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This issue of *Discovery* is largely devoted to travel articles. The ease with which "foreign parts" may now be visited, even in a short holiday, is encouraging a greater number of people than ever before to go abroad and see other lands for themselves. Readers will be tempted to explore Norway by Dr. North's article on Finnish Lapland. Farther afield, Mr. Anstice sends us an account of a holiday in the byways of Japan, while Baroness von Langenn writes of her experiences among the Hopi Indians. The Editor again offers a first prize of five guineas and a second prize of three guineas for the best illustrated travel articles submitted before August 31st. The length should not exceed 2,500 words.

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Lord Rutherford's review of the first year's work of the Academic Assistance Council, which was published in *The Times*, is a sufficient answer to the attempts made in Germany to justify the National-Socialists' action against certain scholars on the ground of race or political opinion. Dr. J. Stark,

President of the Physikalisch-Technische Reichsanstalt of Berlin, in particular, has endeavoured to make light of the hardship which has ensued, pointing out that in many instances resignation has been voluntary. Even if this were true, which is not admissible in an appreciable number of cases, exile may none the less be a hardship if brought about by intolerable conditions. The Academic Assistance Council has not had sufficient resources to enable it to offer more than a very inadequate assistance. It reports that it has on its lists no fewer than 1,202 names, and that while 389 scholars and scientists have been helped to carry on their work, 813 remain unemployed. These figures speak for themselves and need no further emphasis.

The Council's report offers ample refutation of Dr. Stark's attempts to show that the exclusion of Jewish scholars and scientists was justified on the ground that they made no contribution to the general good of the community, but worked exclusively for their own ends. Such an argument is not deserving of serious consideration, especially when viewed in relation to the names of world-wide repute which appear among the exiled workers. Germany, however, has lost more than the services of some of her foremost scientists. The Aryan theory of Germanic culture and race has been shown to be scientifically unsound again and again. In demanding from those who remain complete subservience to a political idea, and the acceptance of a doctrinaire misinterpretation of scientific fact, Germany has crippled her scholars and scientific workers and at the same time has dealt a blow to her intellectual prestige from which it will be difficult for her to recover. The significance of the action of the Academic Assistance Council lies not so much in the help which it offers to scholars who have suffered for their race or creed, but in its expression of a profound belief in the right to intellectual freedom and a vindication of the international status of learning.

The relation of the state to scientific research is a delicate question to which attention has been drawn, and not without arousing some qualms, by the recent course of events in Germany, Russia and Italy. On the whole Great Britain has been fortunate in that in this country much has been left to private and personal enterprise. This system, or apparent lack of system, has fostered freedom of initiative and enterprise, while public authority, in the long run, has rarely failed to assume responsibility for undertakings which were on the way to outgrowing the capacities of private management. One of the most successful of such enterprises taken over by the State is the

National Physical Laboratory at Teddington, which for eighteen years was supported by the British Association. This institution has so extended its operations that it now occupies fourteen buildings in grounds of fifty acres. The latest report, reviewed on another page, shows that its research touches the interest of the citizen at innumerable points. In the past year it has ranged from the investigation of high wind-speeds in relation to aircraft to the accuracy of 16,000 taximeters in use on the London streets.

Aberdeen, where the British Association for the Advancement of Science will hold its annual meeting from September 5th—12th next, has been visited by the Association on two previous occasions. The first was in 1859, when the Prince Consort, who had already been a member of the Association for some years, occupied the Presidential chair and delivered an address of no little weight, in which he deplored the neglect of science by the general public. The second meeting was in 1885, when Sir Lyon Playfair was President. This year the President is Sir James Jeans, who has been elected by the Council of the Association to fill the vacancy caused by the lamented death of Sir William Hardy in January last. Sir James will deal in his Presidential address with "The New World-Picture of Modern Physics"—a subject which will certainly attract a large and attentive audience.

In the list of lectures and communications which appears in the programme, so far as provisionally arranged, there is evidence of a notable readiness to follow the lead given by the Council at its Leicester meeting, when attention was directed to what was felt to be a grave issue of the moment—the relation of scientific advance to social progress and welfare. It is hoped to arrange for an evening symposium on the general question, while several of the sections deal with problems of particular application. The Economic Section is arranging with other sections to formulate a policy of technical education and industrial recruitment.

The usual arrangements have been made for alternating receptions and lectures for the evenings while the meeting is in progress. Of the ever popular evening discourses, one will be a memorial lecture for the late President, Sir William Hardy, which will deal with the subject with which he was closely associated—the preservation of meat, fish and fruit. The second evening discourse will be delivered by Sir William Bragg, his subject being "The Exploration of the Mineral World by X-rays."

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The Origin of the Carolina "Bays."

By F. A. Melton.

Associate Professor of Geology, University of Oklahoma, U.S.A.

The possible meteoritic origin of the Carolina "bays" is suggested by a study of these curious basins, which are found over a large area in the United States. The author's investigations have been aided by aerial photography, which played an important part in this discovery.

IN an area of at least 40,000 square miles on the coastal plain of the Carolinas there exists a great series of elliptical basins locally called "bays." The region in which they occur is bounded approximately by the Savannah River on the south and by the James River at Norfolk, Virginia, on the north. Ranging in size from depressions only a few hundred feet in diameter to others which are two miles long and more than one mile wide, these features are distributed at random over the surface. It is estimated that there are at least a hundred bays with lengths greater than one mile. Not less than fifteen hundred are more than a quarter of a mile in diameter, and the total number now exposed can hardly be less than three thousand. They should not be confused with the numerous sink-holes or solution basins of irregular shape which dot the southern coastal plains. This mistake has often been made, however, so inconspicuous are the bays to an observer on the ground. Their existence near Darlington, South Carolina, was noted in 1895 by L. C. Glenn; but discovery of some of the more significant relationships was impossible before the introduction of aerial photography.

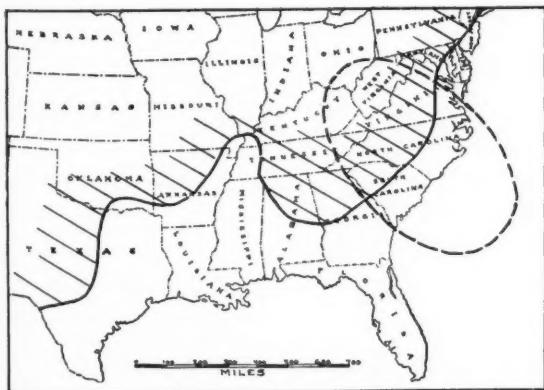
The chief photographic contribution, and at the same time the most fertile source of accurate knowledge, is an aerial mosaic map of an area of about

200 square miles near Conway in Horry County, South Carolina, 65 miles seaward from Darlington. The author is grateful to the Myrtle Beach Estates and to the Fairchild Aerial Surveys for the privilege of examining the photographs, and is especially indebted to Mr. E. H. Corlett. A careful study of the photographs showed that the origin of these bays involved problems of extraordinary interest; the author, together with his colleague Dr. William Schriever, therefore visited the region in order to confirm his deductions and to make additional observations beyond the area of the mosaic. Dr. Schriever has given valued criticism during the preparation of this article.

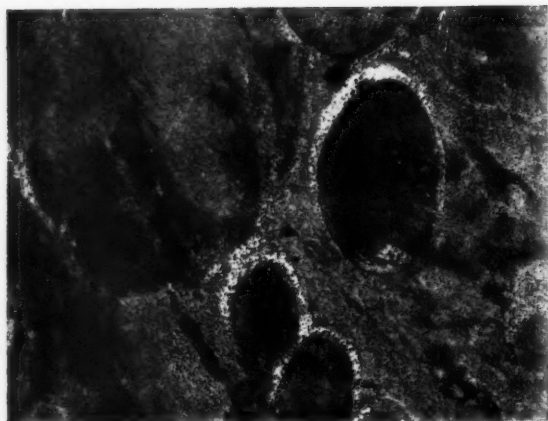
A Striking Feature.

The average ellipticity of 43 conspicuous bays near Conway is 0.336, and the mean deviation from the average is only 14.3 per cent. of this value. Careful examination shows that the ellipticity varies with the diameter of the feature. It is, in general, greater for the large bays than for the small ones, that is, the small bays are more nearly circular. The long axes of the bays, as revealed by the mosaic, are nearly parallel, the mean direction being south 46 degrees east. The average of the deviations from the mean direction is only 3.08 degrees. Since the allowable error in determining the long axis of a bay is greater than this amount it is obvious that the parallelism is striking. Likewise throughout the entire region the major axes seem to maintain, at least approximately, a direction of south 45 degrees east.

A peculiar elevated rim of light coloured soil is almost invariably associated with these basins. While it is usually present only at the south-eastern end, there are a few instances in which a bay is completely encircled by it. In such cases, however, the elevation is invariably larger at the south-east than elsewhere. Double and triple rims are not uncommon. They are arranged concentrically about the central depression and conform to the systematic relationship just stated—that is, they predominate at the south-eastern end. These rims possess very gentle slopes. A typical one near Conway, rising five feet above the



Map of the south-eastern United States, showing the approximate limits of the "bays" according to present knowledge.



Aerial photograph of a typical bay near Conway, South Carolina. (Fairchild Aerial Surveys, Inc.)

surrounding surface, possesses a width of 250 feet at the base.

The mutual intersection of some of the bays implies that they were not formed simultaneously. Where the interference is of such a nature that one is somewhat obscured by another, the bay preserving its entire elliptical outline may be of either large or small size. Examples of both relationships may be seen. Though it is not a common occurrence, small depressions are occasionally found *within* larger ones; *between* them, however, the small features occur in considerable numbers. These relationships are to be expected if the depressions, once deeper than they now are, have been partially filled by sediment. In this way small features within the large bays may have been totally covered and obscured. Regardless of the origin, such conditions, having been observed on the mosaic and verified in the field, may be considered as evidence that the process of filling has taken place.

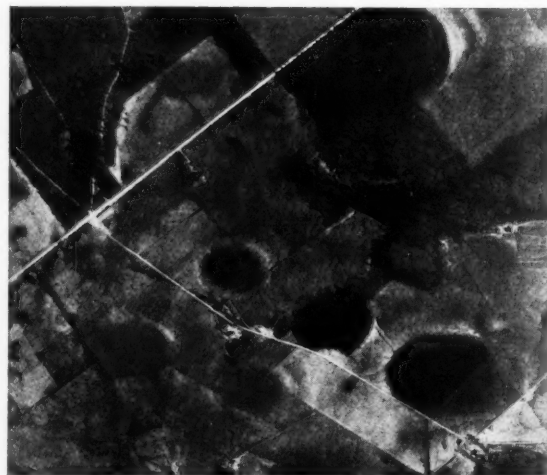
In the area covered by the photographs the bays were once beneath the sea. Proof of this statement is found in the fact that beach ridges of an old shore intersect and obscure several of the depressions. These ridges mark the successive positions of a beach which, according to Mr. C. W. Cooke of the United States Geological Survey, belongs to the Pamlico or Satilla terrace—probably late Wisconsin (Pleistocene) in age. Not only have the depressions been obscured and their rims partially removed by wave and current action, but there are a few features visible on the mosaic to be explained only as basins which have been completely filled and buried by the beach material along this old shore. In the entire region the number

of bays which have thus been buried is doubtless very large. Several features which resemble those under discussion were seen within a few miles of the "fall line," but nothing has been found on the crystalline rocks of the Piedmont upland. Aerial photographs are not available, however, to facilitate a search of this higher terrain.

The depressions in the area under discussion cannot be younger than the Pamlico shore. On the other hand, they cannot be older than the youngest strata in which they have been excavated. From the geological information now available the author concludes that these beds belong to the Waccamaw formation of Pliocene age. The time of origin was therefore between that of Waccamaw-Pliocene and of late Wisconsin-Pleistocene.

It is probable that the bays of the entire coastal plain were developed during or prior to the formation of the well-known surfaces of marine planation. On the older and higher terraces essentially the same relationship exists between volume of rim and area of bay that is found on the relatively young Pamlico surface, where the beach ridges are still clearly seen.

The facts which any theory of the origin of the bays must explain are their elliptical plan, the nearly parallel alignment, the elevated rims completely encircling some of the bays, the elevated rims invariably predominating at the south-eastern end, the ellipticity increasing with size, the double and triple rims, the intersecting bays (integrity of shape being maintained by either large or small bays in different cases), and the probable absence of bays in Piedmont upland.



Bays near Fayetteville in North Carolina, 80 miles north of Conway. (Photograph by U.S. Army Air Corps.)

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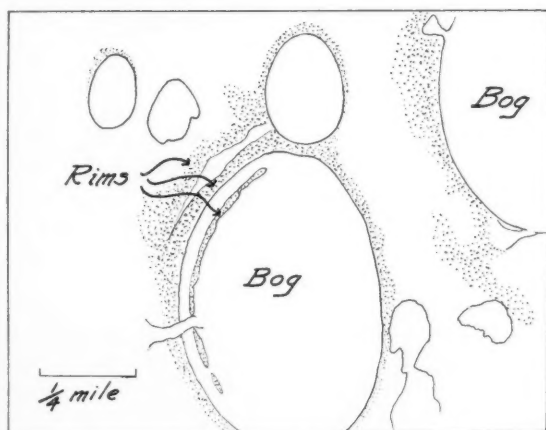
Though space is lacking for a complete discussion of the various hypotheses which might explain the origin of these unusual features, the following have been considered: the action of wave and shore currents, wind, solution, vulcanism, submarine scour, a meteoritic shower or colliding comet.

The Meteoritic Theory.

Judging from the available data one may conclude that only the meteoritic hypothesis seems adequate to explain the facts of observation. Indeed it is at once suggested by the elliptical shape, the parallel alignment, and the systematic arrangement of elevated rims. Consider, for example, the collision of a shower of meteors with the earth and determine if such an event is capable of explaining those facts which any acceptable theory of origin must explain.

(1) Meteors striking plastic material at angles between 35 and 55 degrees from the vertical would produce indentations elliptical in outline.

(2) The meteors in a single shower would move

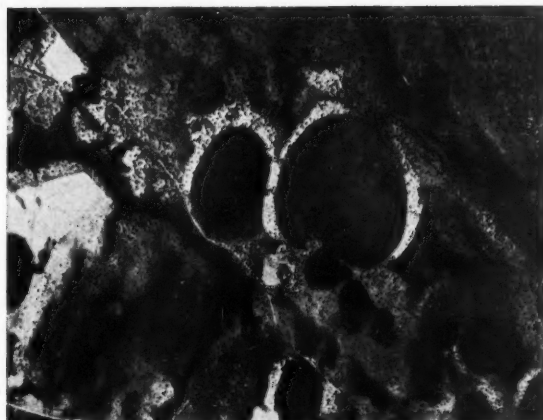


Sketch of a bay near Conway possessing three rims, a not uncommon feature.

toward the earth along nearly parallel paths and would leave indentations with major axes approaching parallelism.

(3) The material of the earth would be thrown out in all directions by the impact and would gather around the depressions. Hard strata would probably be shattered into fragments both large and small, though it is doubtful that pieces of large size could form in fine grained, unconsolidated, and water-saturated clastic sediments.

(4) If the cosmic masses approached this region from the north-west, the major axes would have the



The intersection of some bays implies that they were not formed simultaneously. (Fairchild copyright photograph.)

desired alignment. More material would be thrown toward the south-east than in any other direction, thus making the rims larger at this end.

(5) As the meteors approached the surface, small bodies would be retarded by the earth's atmosphere more than would the large ones. The former would thus spend more time in the atmosphere than the latter and would be given a greater vertical-component velocity by gravitational attraction. The small bodies would, therefore, strike more nearly vertically than the large ones and their impact scars would have the observed relationship of small ellipticity.

(6) Multiple rims could be produced by the successive impacts of two meteors in approximately the same place. Or should a meteor, on striking, push some of the soil ahead of it, there would probably result an upward bulging of the surrounding surface. If a separate elevation were formed from the soil which was ejected two rims would thus appear from a single impact.

(7) Neighbouring scars formed at different times could overlap and produce the mutual interference of outline that is sometimes seen. In a series of overlapping impacts, the most complete rim would be formed by the last meteor to strike the surface. Thus a small bay could partially obscure a large one, or vice versa.

(8) In case the cluster were of globular shape much of the Piedmont and Southern Appalachian regions, in addition to the coastal plain, would be included in the area struck.

Sub-aerial processes would attack the scars, levelling rims and filling craters at a rate increasing with the height and relief of the surface. Erosion of the coastal

plain would proceed slowly, except near the large rivers which could soon remove all topographic signs of the scars in their immediate vicinity. The advance of the sea in Pleistocene time would superimpose the effects of its action upon those already produced by weathering, by streams, and by wind. Should the impacts occur through the shallow ocean water during the marine invasion, the volume and velocity of the ejected material, as well as the area covered by the resulting rims, would probably be less than if the impacts occurred on land. In either case, whether the collisions took place prior to, or during the inundation, if there were strong ocean currents, such as the Gulf Stream, the water scouring at the bottom would further reduce the height and probably also the width of these protuberant rims. If the currents were sufficiently vigorous the ocean bottom might be eroded to such an extent that the resulting scars would be essentially horizontal sections of the original features.

The meteoritic hypothesis thus develops the origin of the facts which any acceptable theory must explain. But it should be tested in every way in order to avoid error. Is it possible that there are other logical consequences of the hypothesis which the observed facts cannot fulfil?

Two Possible Flaws.

In at least one or two respects the author is not convinced that the facts are adequate to substantiate theory. Beds of coastal plain sediments in a number of cases seem to lie flat beneath the bay rims, yet they are above the level of the enclosed bay. Should this condition prove to be common it would be necessary, in order to retain the meteoritic hypothesis, to postulate widespread reduction of the original surface through marine planation.

If the supposed scars had been filled with loose sand before the erosion began it is conceivable that the drift of ocean water along the bottom would scour this fresh and less resistant sediment more effectively than it could remove the surrounding relatively hard material. Should these ocean bottom currents move prevailing seaward, crescent-shaped rims composed of the coarser grained sediment might thus be piled up around the south-eastern ends of the filled basins. Aerial photographs have lately been made which show such lobate submarine bars, convex seaward, just off shore near San Diego, California. In the western edge of Lake Tahoe similar features are seen. In both cases, however, no elliptical basin may be found; the crescent is complete in itself. This modification of the hypothesis seems to involve the

corollary that the rims should be the largest where the bottom currents were most vigorous. At all events the more variable in direction and intensity were the currents the more irregular in position and mutual relationships should be the rims. Near Cape Fear, North Carolina, such irregularities seem to be more conspicuous than in the more protected coastal re-entrant near Myrtle Beach. While this modification may help to explain the rims, the problem of the elliptical basins still remains.

Next, in the few rims thus far examined there is a noteworthy absence of bed-rock fragments larger than sand grains. There are many hundreds of bays not yet studied, however, in which such pieces may occur. Moreover, it is not a certainty that large fragments are to be expected in unconsolidated and water-saturated clastic sediments. The few thousands of years which represent the minimum age of the features are perhaps sufficient for weathering to eliminate the fragmental texture and reduce the soil to its ultimate mineral constituents.

This length of time would likewise permit the removal of meteoritic fragments composed of iron or basic silicate minerals which may have been exposed at the surface. At all events the author found nothing definitely of cosmic origin, though there is a well-known concentration of meteorite discoveries in the Southern Appalachian region, in Virginia, North and South Carolina, Georgia, Alabama, Kentucky, and Tennessee. The accompanying map shows that the probable area of bombardment includes much of the Southern Appalachians. Thus the numerous meteorite discoveries in this region may be additional evidence of the reality of the shower which the author has assumed. A meteoritic cluster having the dimensions indicated is probably of the same order of size as the nuclei of some of the smaller comets.

Future Studies.

A study of the magnetic and, if possible, of the electrical and gravitational conditions of isolated features will be attempted in the near future. A photographic examination of the lower Piedmont area, as well as a careful search for large fragments in the rims of bays situated near the "fall line," would aid in testing the hypothesis here presented to explain the origin of these interesting features.

The largest of the possible meteorite scars referred to in this article is occupied by Lake Waccamaw in south-eastern North Carolina. It is seven miles long and five miles wide. Though it may possibly be a double basin, nevertheless each one must be very large.

The Progress of Physical Research.

The Report of the National Physical Laboratory for 1933 was published last month. The following review indicates the wide extent of the researches now carried out at Teddington, where the latest equipment is a new Acoustics building.*

THE National Physical Laboratory, which was founded at Teddington in 1900, is now a large institution occupying 14 large buildings in grounds of some 50 acres, and with a staff exceeding 600. It is devoted to research and test work in the various branches of physics and engineering, and is responsible for or assists the maintenance of the majority of the official physical standards of the country, e.g., length, mass, temperature, candle-power, and the electrical standards.

The Acoustics Building, which has been taken into occupation during 1933, presents unusual and interesting features. No two walls of any room are parallel and the ceiling is at an inclination to the floor—the purpose being to prevent the formation of the cross-reflections of sound which are set up in rooms of regular shape. Further, the building is a hollow shell in which each room is an independent isolated structure carried on cork pads, so that sound cannot be communicated from one room to another, and so that extraneous sounds do not penetrate into the rooms. In this building researches on the reverberation, absorption and transmission of sound will be carried out under ideal conditions, and it is satisfactory that this country now possesses unsurpassed facilities for the study of sound and noise, the importance of which has only been realized of late years.

New Wind Tunnels.

It is well known that in aerodynamic research, a model of an aeroplane is suspended in a tunnel through which passes a stream of air at high velocity, the force of the air on the various parts of the model being measured by means of balances. The laboratory possesses a number of such tunnels, the highest wind-speed available hitherto being about 75 miles per hour.

A new tunnel with a wind-speed of 140 miles per hour has been built and put into use in 1933, and a second similar tunnel is under construction. These are of the modern open-jet type, i.e., the central, working section is not enclosed, but an object can be thrust from the surrounding still air into the centre of the wind-stream. The wind-stream is so powerful that a man could not possibly stand against it—indeed the force upon him would be considerably greater than his own weight. The jet of high-velocity air is about 8 feet across, and

an expenditure of energy at the rate of 400 horse-power is necessary to maintain it. The much higher air speed attainable in the new tunnels is of the greatest value in view of the continuously increasing speed of modern aircraft.

During 1933 the Radio Research Station at Slough has become part of the National Physical Laboratory, which also conducts a radio sub-station at Lenchar, in North Scotland, which is at present being mainly used for research on atmospherics. The work of the department includes researches on the propagation of radio waves and the structure of the ionosphere or reflecting region surrounding the earth, directional wireless, and the origin and nature of atmospherics. In 1933 it took part in the radio expedition, which, under the leadership of Professor E. V. Appleton, undertook observations at Tromsø, in connection with the International Polar Year.

The Control of Sound.

The importance of sound-proof rooms in broadcasting studios and of the control of sound in cinemas is well known, but it is perhaps not realized that success in these directions would be impossible without the fundamental researches on sound.

The report gives two results of general interest which have been obtained during 1933. A common method of reducing the transmission of sound between two rooms is to employ a partition composed of two layers of material with an air space between. In the same way double windows are often used to prevent extraneous noise from entering a building. The surprising result has emerged from exact measurements at the laboratory that unless such a double panel is properly designed it may actually transmit more sound than one of its panels used alone.

It is a familiar fact that carpets and hangings are employed to deaden sound in a room which is too reverberant, and a further interesting result which has emerged in the work of 1933 is that carpets are much more effective as absorbents at the lower frequencies when they are used with underfelts.

Research on improving the refrigeration in ships' holds is also mentioned in the Report. The most serious influx of heat into a refrigerated ship's hold is through the ribs of the ship, and a novel way of investigating this leakage has been developed at Teddington. A small metal model of the part of the

* National Physical Laboratory report for the year 1933. (H.M. Stationery Office. 13s.)

hold under investigation is made and an electric current is passed through it. As the laws of transfer of heat and electricity are the same, electrical measurements give a picture of the flow of heat to the hold which would be difficult to realize by thermal experiments.

As a result, it has been possible to re-arrange the heat insulating material in refrigerated ships so as to reduce this heat leakage by some 10 per cent.

Cadmium Light.

In the Metrology Department a piece of work has this year been completed which is likely in the near future to realize at last the ideal behind the origin of the metre, *i.e.*, a standard of length which is expressed in terms of an invariable physical constant. The basis of the measurements recently completed is the length of the wave of red cadmium light, and both the yard and the metre have been accurately measured in terms of this constant, which is itself only about one forty-thousandth of an inch long. Such measurements can be repeated exactly after any interval of time with an accuracy of nearly one part in 100 million. In this they have a great advantage over measurements on material standards, which are liable to grow or contract slightly with time.

It is perhaps not generally realized that all taximeters used on cabs in London are tested annually by the laboratory. The change of fare introduced last summer led to a large temporary increase in the work, as every meter, after alteration to record the increased fare, had to be passed by the laboratory before the Commissioner of Police would allow it to be fixed to a cab. Over 16,000 taximeters were tested during the year.

The use of coal gas for the propulsion of heavy road vehicles has now become established, and a number of such vehicles are in regular operation in various parts of the country. The success of the scheme was largely dependent on the production of a suitable container for the gas; the container must not be too heavy or bulky and must carry sufficient gas for a reasonable range. These conditions were met by making cylinders of nickel-chromium-molybdenum steel, in which the gas could be compressed to a pressure of 3,000 pounds to the square inch. The laboratory has carried out investigations to determine the conditions necessary for the safety of these cylinders, and will carry out further tests on cylinders which have been in use for various periods to ensure that there is no serious deterioration.

The Metallurgy Department at Teddington is now undertaking dental research. When a tooth is decayed,

the dental surgeon may cut away the bad portion and fill the hole thus made with a "dental amalgam." This is made by mixing very fine particles of an alloy (containing silver, tin, a little copper and sometimes a very small amount of zinc) with pure mercury. When the mixture is packed down in the tooth, it "sets," *i.e.*, it becomes harder and harder with time. During this "setting" the filling changes in size; it may either expand or contract, or may first expand and then contract, or vice-versa. The best filling is clearly one which expands by only a very small amount (*e.g.*, four ten-thousandths of an inch in six hours) so as to fill the cavity completely, and which does not show any further change with time. Such a filling can only be obtained if the composition of the alloy is suitable, and if the alloy and mercury are mixed under suitable conditions.

Researches are being conducted at the laboratory to determine the most suitable composition and the best way of making a filling. Experiments have been carried out using one dental alloy and varying the conditions of mixing and packing. The change in size during "setting" has been measured at mouth temperature. The results so far obtained have shown that the volume change depends less on the relative amounts of alloy and mercury in the amalgam than on the way they are mixed together. A very simple method of mixing has been found to be most effective.

Shipping Problems.

It is satisfactory to be able to record an important increase in the number of ship models tested in the ship tanks for industrial firms during 1933. Designs for 45 ships were investigated, as compared with 28 during 1932; indeed the number for 1933 is the highest since 1929, a sign of increasing industrial activity, which is further emphasized by the fact that the demand for tests has steadily increased during the latter half of the year.

One of the most important results achieved in this Department relates to the smaller coastal vessels. Before 1928, when this research was initiated, comparatively little scientific study of the design of these vessels had been undertaken. Valuable results have been achieved in the course of the work; it has been found, for example, that the fitting of a streamline fin behind the propeller increases the efficiency of these vessels by $7\frac{1}{2}$ per cent with ship loaded and by some 10 per cent in ballast. Other valuable suggestions for designers have also been evolved, and it is obvious that there are still further considerable possibilities of reducing the running cost of such vessels.

Discovery

The author

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Playing at Indians.

By Baroness Vendla von Langenn.

The author visited the Hopi Indians and gives a vivid description of the Snake Dance and other ceremonies which she observed during an expedition among these interesting tribes.

A CHILDHOOD dream became reality through an invitation to visit an old friend of mine on her Arizona ranch. For while staying there I was able to visit the Hopi Indians and learn something of their habits and customs.

An Indian guide named "Pole," which means butterfly, came to help me prepare for the journey. Butterfly was an old man of sixty-eight years, slim, with long lank hair, held by a dirty band round the head. His eyes sparkled as we packed sausages and corned beef, while for my benefit sardines, hard-boiled eggs and bread were added to the provisions.

To reach the Indian villages from Tuba City we had to ride across the desert. The ponies could only proceed slowly through the deep sand, but after some hours we had a wonderful view of the Grand Canyon in the far distance. The Indians carried on at a regular joggle, gripping and manoeuvring their ponies with mocassined feet and occasionally flicking them with short whips. This joggle was most unpleasant to me the first day, though when I became used to the action it seemed quite comfortable. We passed Coal Canyon on our left, the black and white walls rising straight out of the plain. Empty eagle's nests were visible on inaccessible spurs. The sun was now scorching—my face burnt as if on fire. Butterfly seemed to swim in front of my eyes; his thin mount took on the aspect of a gigantic beast, and the provision sacks seemed to swell enormously.

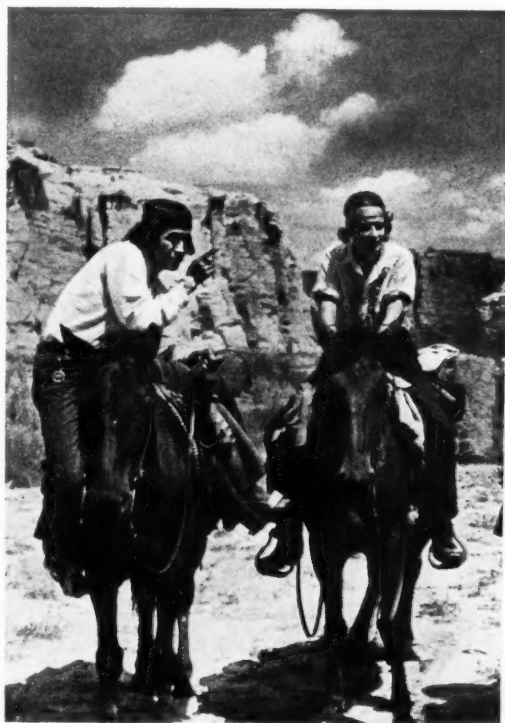
At midday the desire for water became unbearable, but no water was to be found. Ahead of us a Navajo wagon was making its way along, so urging

the ponies we caught up the wagon and inquired where the next *hogan* was. (The *hogan* is the round clay hut of the Navajos.) "Four miles ahead." When we approached it the dogs barked furiously and five dirty youngsters peeped anxiously out from the hut as they saw the "Bahana" (myself).

We dismounted, removed saddles and hobbled the ponies' forelegs. Then we sat down at a fire (which is always burning) by which stood the everlasting coffee pot. Butterfly, who spoke the Navajo dialect well, asked the woman to make coffee for us as we had forgotten to pack cooking utensils. Soon we had three women and the five children about us. I gave them some coffee, sugar and hard-boiled eggs. But they did not know how to eat the eggs and I got a great deal of fun out of their antics, especially when I cracked one on my head with very earnest mien—and

they, thinking this the correct manner of dealing with hard-boiled eggs, followed suit.

The women were unpleasant until Butterfly explained that I had come from far across the Great Water from whence the sun came. This was very effective. They grinned and one of them disappeared into the *hogan* to reappear quickly with a bowl of mutton and maize corn. After a while the husband of the two women appeared, and when everyone had eaten and smoked enough, we again set out on the ponies through the desert, climbing all the time by steep paths and almost being hooked out of the saddle as we squeezed round rocks. An eagle circled high overhead. Butterfly sang in a soft quaking old woman's voice.



The author riding in the Blue Canyon with a Hopi Indian guide.



Sheep corralled for dipping, a Government regulation that is hated by the Indians.

Three hours this lasted until we had risen high enough to be able to survey the whole plain. On the horizon, Hotevilla, an Indian village was visible and we made towards it.

Looking back over our shoulders we had a marvellous view. Far in the west the sun disappeared behind the mountains, blood-red clouds swam in the ocean sky, and in the afterglow the poor stone huts looked like fairy castles. We halted before the hut of Butterfly's sister and climbed some small steps on to the roof of the house, here sitting down to meal with Butterfly's sister and eight men. All spoke the Hopi tongue with soft voices. I understood nothing and felt very foolish. Butterfly was the day's hero—he was radiant; he ate and smoked and acted like a dashing cavalier.

Next morning when we saddled up we were the centre of entertainment for a horde of children and dogs. From here we were heading for Oraibi, an interesting place from which Butterfly originated. With much frilling he related how long ago a chieftain had hunted many Hopis away from the place, because they were bad Indians who would not send their children to school. The fugitives had founded Hotevilla. Near Oraibi there is a rock on which the curse of the chieftain who began the civil war is graven in Indian sign language.

Later on, we arrived at the Hopi village of Chipaulovi. Here we went directly to the piazza where the Snake and Antelope priests would appear at sundown to perform the ancient seasonal dance, famous in all lands where Indians dwell. Our stay was at the house of a friendly Indian with whom I had become acquainted on a ranch near Flagstatt. The chieftain, Joe Sekakuku, who kept a small shop in

Flagstatt for Indian curios and handwork, is a rare mixture of civilized Indian, baptised Christian and pagan. In spite of everything he dances each year in the primitive festivals of his people. It is strange how the ancient belief in the "Thundercloud," the "Katchinas" as interceder with the Great Spirit, remains ever stronger than all the teachings of grafted civilization and Christianity. An old Indian once said to me: "Why do not the missionaries leave us in peace? Our beliefs are good, we learn good, and not to interfere with anyone. All of us have the same religion. But now the missionaries come with seven religions. They all talk differently. And they split our people up, causing trouble amongst us. Why don't they leave us alone." What could I reply?

There was excitement in the village and a tense expectancy. On the flat roofs of the houses like eagles had been fastened with chains and they sat there blinking at the last rays of the dying sun. These



A hut of dried branches and leaves, in which the author took shelter in the desert.

eagles are stolen out of the nests in spring and are carefully tended during their development in order that they should attain the full growth, when they would supply the much-valued feathers used on the dance costumes.

As soon as the sun disappeared the first movement of the festival began. Every head turned in one direction from whence a dull murmur came. Then suddenly the half naked figures of the Antelope Priests appeared round the corner of the houses, moving rhythmically, with white ceremonial scarves bordered green-black-red round the loins, the trunk bare and painted with white signs, and long lank black hair. In their hands they carried the leaves of maize plants.

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Entering the piazza they made one round at a quick pace accompanying their chant with the noise of percussion instruments. The *tempo* increased up to a wild, vigorous swirl. The Snake Priests were here now, their deer skins decorated with lightning and cloud signs, and the feathers in their hair making them look like so many devils as they writhed about. They stamped forcefully with the right foot to the tune of a horrible booming chant, and danced in pairs with the Antelope Priests. For half an hour this mimicry dance went on and then all was over for the night. It was like a short, wild nightmare. The next day was to be the great occasion of the Snake Dance with prayers for rain—which always comes sooner or later.

I slept at Joe's sister's place, and was awakened early to be informed that the priests would be soon arranging the Rain Races, so I pulled my leather belt tight (the only toilet here), and in bright, clear light I made my way to the edge of the rock wall. Below lay the Indian school, the green of the trees being like an oasis in the wilderness. As far as the horizon stretched the prairie. In the distance moving spots could be seen, one—two—ten, eleven, one behind the other. As they drew nearer, naked brown bodies were distinguishable.

Below me under the rock they disappeared, but the leader soon broke view again above, a slender breathless savage, his only article of attire a loincloth. He carried a small pitcher filled with water from the spring far out in the desert. He speeded the last few steps up the steep path to the altar enclosure, where all prayers are offered up and which may only be entered by the priests. As the last runner climbed over the rock wall everyone followed—girls in festive dress, half-naked youngsters with maize cobs in hand,



Priests in eagle feathers and deer skins taking part in a ceremonial dance.

men and women, all ran up to the wall. There stood the chief Snake Priest with bow and arrow in hand, beside him a colleague with a humming instrument. He first bent the bow and released an arrow, at the same time crying solemnly to each of the four quarters. After each shot his companion whirled the instrument round his head, as a symbol of lightning and thunder. All this was a call for rain, of which these poor people see little.

We now drank coffee, eating ceremonially of a paste of maize-meal which had been buried and was cold, sticky, and tasted horrible. After breakfast I rode over towards Walpi, the oldest Hopi village in Arizona. On the plain there is a spring where shepherds camped in a circle. Everything that lived hereabouts came to this spring for water. They came in wagons drawn by poor thin ponies, or walking with pitchers, or on mules which frequently had the ears cut quite short, this being the penalty when a neighbour caught one in his maize plot. Walpi lay high up on the hill; nearby was Tehua. A long time ago, before the whites appeared in the land, Hopis lived here pressed in by the unfriendly Navajos and Apaches. The Tehua came and begged that they might settle here and as they were good fighters permission was given. In gratitude the Tehua protected the Hopis when threatened, and from that time the Tehua lay next to Walpi.

By twelve o'clock we were back in Chipaulovi for the midday meal. I rode up to the village in order to stake out a good place from which to view the Snake Dance. Soon a stream of Bahanas, Navajos, and Hopis swept into the piazza. On every roof sightseers stood and sat closely packed: Navajos in their tribal



Navajo women making bread, the dough being mixed with fat and fried.

costumes with great hats—they all wore their full festive ornamentations; Hopi men with coloured hairbands, women with cotton shawls, cowboys, and Pimas from New Mexico in beautiful coloured costumes with black hair streaming over shoulders and white leather mocassins up to the knees. We all awaited expectantly.

The dance began, as before, immediately the sun set. The Antelope Priests entered at a quick step and went round the piazza four times. Then they stopped in front of the maize-stalk altar and began a monotonous chant, clapping their hands to the time. Everybody held his breath in anticipation of the Snake Priests' arrival. A murmur, growing steadily louder, reached the crowd and the Snake Priests approached stamping their red mocassined feet, their eyes rolling fanatically. They arranged themselves opposite the Antelope Priests who had all the time continued to sing.

As the chant ended the chief Snake Priest knelt down before the altar, then sprang up suddenly with a deadly poisonous, wriggling rattlesnake between his teeth. The effect was startling. The priest stamped around to the rhythm of the chant again taken up by the Antelope Priests. Another Snake Priest laid his arm round the neck of the chief priest and with a small feather-decorated baton teased the snake to bite. Another pair went through the same performance.

Squirming Snakes.

A hole had been dug before the altar over which a plank was placed. This symbolized the underworld—"Chipeau," the Black Sea of Tears. Here the dancers stamped heavily to encourage the Gods to accept their supplications. Soon all the priests had their hands full of squirming snakes, some more than six feet long and nearly arm thick. From time to time the snakes were laid on the ground and the Antelope Priests sprinkled them with consecrated meal. The crowds stood closely packed and breathlessly still. Here and there a cry would ring out as one of the snakes slipped through the guard, and with lightning speed slithered towards the spectators. The Antelopes have, however, a trick of catching such escaping snakes. With a rapid cat-like movement they grasp the snake behind the head, and swing it elegantly through the air, often right under the noses of the startled onlookers.

The last snake was laid down in the piazza. The singing ceased. The Antelopes threw all the snakes into a heap, a wriggling mass which seems to have a thousand heads. Quickly, but with anxious steps Indian women approached the tangled heap and sprinkled it with sanctified meal. Snake Priests dug their hands in amongst the writhing creatures to bring

out long yellow-brown and grey snakes. And to the four quarters of the compass these peculiar beings stormed out in order to send out the snakes, which during the dances had inhaled the prayers of the priests, as emissaries to the Great Spirit. The Antelope and Snake Priests returned to the altar to purify themselves and drink the herb tea which is the antidote against snake poison. Never will a Pale Face learn the recipe, for the head Snake Priest alone knows the secret of the preparation—and he guards silence.

A Desert Ranch.

We were a fair sized party to ride away next morning to Chimopovi, where another Snake Dance was to be held, my Indian companions including Butterfly, Joe, and his friend Scott. On the return journey we were caught in a tropical storm which prevented us reaching Blue Canyon as we had planned before nightfall. So we accepted Scott's invitation to remain until morning at his ranch in the desert. Half wild horses looked us over as we approached. The ranch was clean and comfortable. Horses and cattle browsed in sparse pastures which had been dried up under long scorching suns. Scott was very proud of his herds which he had developed during many years, and I promised to send him a veterinary book which he badly required.

After dark some Navajos rode in, for, of course, the word had flown round that a white woman had arrived quite alone at the ranch. They were curious. More and more came and sat down on the ground to stare silently at me. But when I handed round cigarettes—of which I always carried plenty, for I knew the Indians' weakness—the ice was broken, and eventually they presented a dance for me which no Bahana had ever seen.

The dancing of the Indians lulled me to sleep and when I woke a new day had broken. We rode off again and three hours later we saw Blue Canyon ahead—one of the most famous natural wonders of Arizona, although we had an uncomfortable ride up steep cliff paths.

On our last day's ride my companions related many interesting stories and legends, when towards evening the high poplars of Tuba City appeared on the horizon. Mormons, the first pioneers in the region, had brought these trees and also peach and apple trees. We took our final rest in the Valley of Moencopi, where Butterfly bade us good-bye, and in memory of the 250-mile ride through the desert he named me Loma-hon-mana—"Beautiful Bear-girl." Slowly we mounted the last hill towards Moencopi, for we had much to reflect upon.

Is Aluminium Dangerous for Cooking?

By J. H. Coste, F.I.C., F.Inst.P.

Chief Chemist, Medical Department, London County Council.

The alleged dangers of cooking in aluminium vessels are frequently discussed in the popular Press, and some pamphlets have been issued by doctors to support the case against aluminium for this purpose. In view of the extensive use of aluminium, Mr. Coste's conclusions are of the greatest interest.

CONFLICTING views are still held on the subject of aluminium in relation to food. Certain physicians have recently expressed the view, in no uncertain terms, that forms of indigestion coming under their notice have been caused by the use of aluminium cooking vessels. Other authorities are of the opinion that no danger is to be attributed to this source.

Aluminium is the third most plentiful element in the earth's crust, but it was only in the year 1827 that Wohler isolated it, although its most characteristic salts, the alums, had been known since the days of Pliny. Its strong electro-positive character rendered its separation difficult, and it was only by heating its salts with metallic sodium that it was first obtained in the metallic form. By 1854 the French metallurgist, H. St. Clair Deville, was able to exhibit in Paris large articles made from it. But it was expensive, and although its suitability for cooking vessels had been suggested, it was not until the production of cheap electricity by water power that it could be commercially utilized. Now aluminium is produced in large quantities in the north of Scotland, where the rainfall is very high and a continuous and large supply of upland water is available.

Early Experiments.

As early as 1886 experiments on its physiological properties were made by Siem, who found that cats were but slightly affected by rather large doses administered daily over a month, and that rabbits, dogs and cats could survive the injection into the blood stream of large doses; the fatal dose for these animals was equivalent to a man receiving about one-third of an ounce. When it is remembered that aluminium salts are styptics and that hypodermic injections of substances which are harmless taken *per os* are sometimes poisonous, the tolerance for injections is remarkable. In 1893 the Prussian War Office, desiring to use aluminium cooking vessels in the army, had experiments conducted which showed that rabbits could thrive for from seventeen days to over two months on a diet containing as much aluminium as would correspond to a man consuming an aluminium saucepan holding 1½ pints in a month, a rate of dissolution which would for ever ban the material from

household use. Experiments were conducted for the *Lancet* in 1913, which showed that there was no obvious danger from its use. Now it is largely used to the partial exclusion of the older materials—copper, tinned iron and enamel, and no widespread ill effects have been observed, nor, I think it may be said, has the medical profession as a whole, either here or in other countries, been puzzled by the occurrence of groups of symptoms for the explanation of which a new cause needed to be found.

Nevertheless, as already stated, some physicians have recently expressed the view that indigestion has been caused by the use of aluminium cooking vessels, and has disappeared rapidly when these vessels were abandoned. Aluminium is not found in any but the smallest quantities in living tissues, but there seems to be good evidence for traces, and none for its physiological value.

In the following brief summary of the present position the case made by physicians against aluminium will be first briefly stated, with the opinion of an eminent physician, who is also a skilled chemist, on their clinical observations. Afterwards some account follows of experimental work intended to clear the situation. It may be said that the determination of minute amounts of aluminium is no easy matter, and that some of the work seems faulty owing to this cause. At a recent and representative discussion on the matter organized by the Society of Public Analysts, the general opinion seemed to be that no case had been made which should cause alarm. This view was based largely on a critical review of the position by Dr. J. H. Burn, Director of the Pharmacological Laboratory of the Pharmaceutical Society.

An American Pamphlet.

A leaflet was widely distributed a year or so ago entitled "Aluminium Poisoning; Some Unusual Sources and Results," by Dr. G. Schmidt. The author had read it before the Mid-West Homeopathic Association of America and the American Association for Medico-Physical Research in September, 1928. He said "You can get aluminium poisoning through all kinds of foods cooked in aluminium cooking utensils, and even from mixing food or having it stand in these

dishes (once I showed this poisoning myself by eating only one tablespoonful of potato salad mixed in an aluminium dish); from water boiled in an aluminium tea kettle, even if that kettle is lined with one-sixteenth of an inch of lime deposit; even from water standing in an aluminium water pail.

"The symptoms of an acute poisoning from even a medium dose are a peculiar feeling in the stomach, which I would describe as a cross between hunger and a mild pain, coming on within ten to twenty minutes, and lasting about half an hour to an hour, and followed by a lazy, sluggish feeling all over, lasting from four to eight hours. After you have noted these symptoms several times on yourself you will know at once when you have been poisoned by aluminium." Dr. Schmidt also attributes ulcers and cancer to "the effort of the body to throw off chronic excess poison-sodium muriate" (*i.e.*, common salt) "and aluminium nitrate being excreted." The symptoms described would before the use of aluminium probably have been attributed to sloth or gluttony. It is difficult to take the paper seriously.

A Weighty Attack.

A more weighty attack has been launched by Dr. Le Hunte Cooper, an English physician, who circulated among the medical profession a pamphlet on the danger of food poisoning by aluminium. In this he gave details of several cases, including his own, and some account of experiments. Of the cases described, pointing to ill effects arising from the continued injection of aluminium compounds, Sir William Willcox, speaking at the general discussion of the aluminium question by the Society of Public Analysts, said "He had been practising medicine for a long time and had seen many thousands of cases of ordinary dyspepsia, but never one in which the symptoms had been caused by aluminium. He had studied carefully the records of the clinical cases cited in the pamphlet to which reference had been made, and several of them appeared to him to be obviously attributable to something else than aluminium. In one case the patient, who had a temperature frequently, probably had a chronic appendix. The symptoms subsided, as these symptoms did subside (especially when associated with auto-suggestion), well for a few months. Was it likely that aluminium was as terribly toxic as the author of the pamphlet would have us believe? Aluminium was present everywhere and people were bound to swallow a lot of it. It seemed inconceivable, therefore, that the slight amount from aluminium cooking vessels could have any toxic effect. It was difficult to keep pace with all the patent

medicines, but four or five years ago there was one called 'Alucol,' which was the very latest for the treatment of dyspepsia, gastric ulcers, etc. It was aluminium hydroxide, and was given in dose of 1 grm. from three to six times a day."

The experiments cited so far do not throw any light on the fate of aluminium when introduced into the body. It is clear that, if not so volatile as to escape with the air expired from the lungs (as alcohol does to some extent), anything ingested must either pass into the blood or be voided in the faeces. If it goes into the blood it may be deposited in the tissues on the one hand or separated in either the liver or other organ pouring its secretion into the alimentary tract, in which cases it will be found in the faeces, or the separation may occur in the kidneys, when it will be found in the urine. Of course, all these things may happen together. If a substance is stored its effect may be harmful, beneficial or simply neutral.

The functions most essential for the continuance of a race are growth and reproduction. If animals do not grow they will not reach maturity, and if sexual functions are impaired in the mature animal the race will die out in a few generations. Hence experiments on these matters have been conducted, mostly on small animals which mature rapidly, of which the rat is perhaps the most satisfactory, although both pigs and human beings have been used as subjects.

Many workers on this subject have either fed, or injected into the blood stream, amounts of aluminium compounds far in excess of anything likely to be introduced by the use of aluminium cooking vessels; indeed it may be said that the use of aluminium for this purpose would long ago have been abandoned if the rate of destruction by the action of food were anything like as high as would furnish the amounts given to unhappy animals by some workers. The best estimate of the probable amount of aluminium taken in a day by a man whose food was all cooked in aluminium seems to be that of Massatsch, whose results calculated by Burn give about 13 milligrammes a day, which would equal 0.04 milligramme for an average well-grown rat or say 0.4 for a fair sized rabbit.

Pigs and Rats.

The experiments of Mackenzie on pigs and rats show that from 80 to 97.5 per cent of rather large doses of aluminium was recovered in the faeces and very little in the urine. His sweeping assertion that aluminium excretion is confined solely to the alimentary tract is hardly justified, but that it is mainly so excreted is certain. His experiments throw no light on the

question whether it circulates in the blood, except in so far as the livers of animals receiving aluminium contained rather more of that element than those of the controls fed on an approximately aluminium-free diet. That aluminium does undoubtedly get into the blood streams of animals and man receiving it in food was shown by Steel (1911), who gave dogs very large doses; by Judd Lewis (1931), who administered moderate doses to hospital patients about to undergo operations in the course of which the requisite blood was obtained. Patients on ordinary diet yielded from none to 0.3 parts per million of aluminium in the blood, after aluminium for some days from none to 1.5 parts. (Steel's figures were rather higher.) It appears about four hours after administration and continues for 48 hours or longer.

Underhill and Peterman found but little absorption in the liver, kidney, heart, brain, spleen and thyroid, but concluded that any passing into the blood was mainly eliminated from the liver in the bile. McCollum and fellow workers, confirmed by Dee Tourtellotte and Rask, found still less aluminium in these organs. Mackenzie found that aluminium from solutions injected into the small intestine of rabbits was mostly retained there, very little passing into the blood.

As to the effect of aluminium on the blood Siebert and Wells found that continued injection of large quantities into a vein caused anæmia after some days, in rabbits, the number of red blood cells and the percentage of hæmoglobin being reduced. Their feeding experiments did not yield as conclusive results, and the doses were larger than could occur from ordinary impurities introduced in food.

None of these authors seem to have found any ill effects from the ingestion of aluminium in either animals or man, but Schæffer, Fontes, Le Breton, Oberling and Thivolle (working together) found serious lesions of the upper part of the digestive tract of mice fed on a diet containing aluminized baking powder, whilst the control animals were unaffected. Dogs receiving similar diet were affected in the lower part of the alimentary tract. Not only did the mice suffer as



The extensive use of aluminium in the modern handling of food is illustrated by this meat factory, equipped with all-aluminium pans.

described, but their reproductive powers were seriously affected as compared with the controls. When one reads that the diet contained 4.4 per cent of aluminium and yet a group of ten pairs in four months produced as many as 192 offspring against 328 for the controls, and that another less unfortunate group receiving only 1.3 per cent gave 244, one is filled with respectful amazement at the hardiness of these animals. The authors explain their results by "an elective specific action of the aluminium ion on the ovary."

Against these findings of Schæffer, etc., must be considered those of McCollum and Rask, who found that young rats grew well and satisfactorily reproduced on a diet containing 0.06 per cent of aluminium, a more reasonable but still a large dose; Myers and Mull, who kept rats for 100 days on a diet containing 2 milligrammes a day (equal to, say, 0.6 gramme per man per day or 45 times the amount probably taken from cooking vessels) and raised four generations, weaning the fifth, and Mackenzie, who raised successfully three generations of rats.

Three sets of experiments on students of American Universities, extending over 7 months, undertaken in 1914 for the U.S.A. Department of Agriculture, showed no effect of aluminium on their general health.

Other experiments might be quoted, but the above, I believe, gives a fair statement of the position, which seems to be that, although aluminium is absorbed in small amounts when administered in food, there is no reason for considering it harmful when its sole source other than the food itself is the vessel in which it is prepared.

*Science and Religion—VIII.***Religion as an Objective Problem.**

By Julian Huxley.

Professor Huxley begins by analyzing religion as a human characteristic, and proceeds to ask "whether the scientific approach can throw any light on the present crisis in religion and its possible future solution." This article, which will be concluded next month, is discussed by the Editor on page 149.

RELIGION, like any other subject, can be treated as an objective problem, and studied by the method of science. The first step is to make a list of the ideas and practices associated with different religions—gods and demons, sacrifice, prayer, belief in a future life, tabus and moral rules in this life, and so on. This, however, is but a first step. It is like making a collection of animals and plants, or a catalogue of minerals or other substances, with their properties and uses. Science always begins in this way, but it cannot stop at this level: it inevitably seeks to penetrate deeper and make an analysis.

Past and Present.

This analysis may take two directions. It may seek for a further understanding of religion as it now exists, or it may adopt the historical method and search for an explanation of the present in the past.

With regard to the historical approach, it is clear that religion, like other social activities, evolves. Further, its evolution is determined by two main kinds of factors. One is its own emotional and intellectual momentum, its inner logic: the other is the influence of the material and social conditions of the period. As an example of the first, take the tendency from polytheism towards monotheism: granted the theistic premiss, this tendency seems almost inevitably to declare itself in the course of time.

As an example of the second, we have the fact of propitiatory sacrifice in relation to man's helplessness in face of external nature.

The comparative evolutionary study of religion brings out two or three main points. For instance, we have the original prevalence of magical ideas, and their application first to the practical activities of communal existence such as food-getting and war, and only later to the problems of personal salvation: and these latter in their turn come gradually to be dominated more by moral and less by magical ideas. In the sphere of theology we have the early prevalence of rambling myth, and its gradual crystallization into a fully-rationalized system. In this domain, too, we see an interesting evolution from an early stage in which

certain objects, acts, and persons are supposed to be imbued with an impersonal sacred influence or *mana*, and a later stage at which this sacred influence is pushed back a stage and attributed to supernatural beings behind objects.

Finally there is the important fact that religious beliefs and practices have a very strong time-lag—a high degree of hysteresis, if you prefer a physical metaphor.

We next have to ask ourselves what is the result of our other type of analysis, into the nature of religion. In the most general terms, it is that religion is the product of an interaction between man and his environment. It always involves an emotional component—the sense of sacredness. It always involves a more than intellectual belief—a sense of compulsive rightness. It is always concerned with human destiny, and with a way of life. It always brings the human being into some sort of felt relation with powers or agencies outside his personal self. It always involves some sort of escape from inner conflict. These different components may be very unequally developed, but they are always present.

Pushing the analysis a stage further, religion is seen as an attempt to come to terms with the irrational forces that affect man—some cosmic, some social, some personal. These terms may be terms of capitulation or of victory; of compromise or of escape. Here once more there is immense variety.

No Single Function.

A very important further point is this—that there is no single function of religion. We may class religious functions by their external points of reference or by their internal origins. Externally, the first religious function is to place man in a satisfactory emotional relation with his non-human environment, regarded as outer destiny or fate. The second is to do the same for his social environment; the third, to do the same for his personal actions.

Looked at from the point of view of internal origin, the matter is much more complicated. One very important religious function is that of rationalization—

giving coherent explanations in rational terms for acts and feelings which arise from instinctive and therefore irrational sources. Another is that which we have already mentioned, the desire for unity. These two between them provide the theological side of religions.

More fundamental—since they provide the raw materials on which the rationalizing and unifying urges act—are the purely emotional components.

These fall under two main heads—the functions

arising from conflict or reaction between the self and the outer world, and those arising from conflict or reaction between parts of the self. Among the former we may mention the need to escape from frustration and limitation; and the need for enhancement of the actual. Then we come to relations between parts of the self, which are the most potent of all in generating religious reactions. Here we must take account of several basic facts of human mind. First there is the inevitability of conflict. Then there is the illimitable nature of desire and aspiration. Analogous to this last, but in the intellectual instead of the emotional sphere, is man's concept-forming activity, which inevitably gives rise to abstract terms like justice, truth, and beauty. These, being abstract, are empty; but illimitable desire perennially fills them with its imaginations. Then there is the fact of childhood repression, with its consequences, only now beginning to be realized by the world, of a burden of (often unconscious) guilt. Closely linked with this is the obsession of certitude: the mechanism of repression is an all-or-none mechanism, and the conscious accompaniment of such a mechanism is a subjective sense of certitude.

Another very important function is to provide something which is felt as eternal and unchanging (even though in reality it may merely be long-range and slow-changing) over against the limitations and changes of ordinary existence.

But I must not spend too much time on mere analysis. The next question is whether the scientific approach can throw any light on the present crisis in religion and its possible future solution.

The particular situation that confronts the religion of western civilization is this. The concept of God has reached the limits of its usefulness: it cannot evolve further.

Let me amplify this. Supernatural powers were created by man to carry the burden of religion. From diffuse magic *mana* to personal spirits: from spirits to gods; from gods to God—so crudely speaking, the evolution has gone.

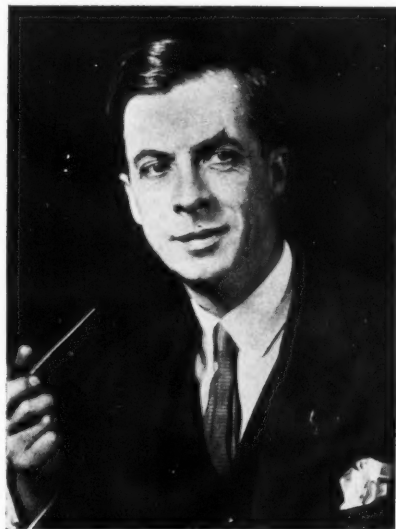
The particular phase of that evolution which concerns

us is that of gods. In one period of our western civilization the gods were necessary fictions, useful hypotheses by which to live.

But the gods are only necessary or useful in a certain phase of evolution. For gods to be of value to man, three things are necessary. The disasters of the outer world must still be sufficiently uncomprehended and uncontrolled to be mysteriously alarming; or else the beastliness and hopelessness of common life must be such as to preclude any pinning of faith to the improvement in this world—then God, and not social life, provides the necessary escape-mechanism.

The belief in magical power must still be current, even if it be in a refined or sublimated form. And the analytic exploration of his own mind by man must not be so advanced that he can no longer project and personify the unconscious forces of his super-ego and his ideas in the form of beings external to himself.

The advance of natural science, logic, and psychology have brought us to a stage at which God is no longer a useful fiction. Natural Science has pushed God into an ever greater remoteness, until his function as ruler and dictator disappears and he becomes a mere first cause or vague general principle. The realization that magic is a false principle, and that control is to be achieved by science and its application, has removed the meaning from sacrificial ritual and petitionary prayer. The analysis of the human mind, with the discovery of its powers of projection and wish-fulfilment, its hidden subconscious realms beyond the ordinary range of consciousness and even of personality, makes it unnecessary to believe that conversion and the



Professor Julian Huxley.

[Bassano]

like are due to any external spiritual power, and unscientific to ascribe inner certitude to guidance by God.

And theological logic, inevitably tending to unify and to universalize its ideas of the Divine, has resulted in a Monotheism which is self-contradictory and incomprehensible, and in some respects of less practical value than the polytheism which it replaced.

If you grant theism of any sort, the logical outcome is monotheism. But why theism at all? Why a belief in supernatural beings who stand in some relation to human destiny and human aspirations? Theistic belief depends on man's projection of his own ideas and feelings into nature: it is a personification of non-personal phenomena. Personification is God's major premiss. But it is a mere assumption, and one which, while serviceable enough in earlier times, is now seen not only to be unwarranted, but to raise more difficulties than it solves. Religion, if it is to continue as an element of first-rate importance in the life of the community, must drop the idea of God or at least relegate it to a subordinate position, as has happened to the magical element in the past. God, equally with gods, angels, demons, spirits and other small spiritual fry, is a human product, arising inevitably from a certain kind of ignorance and a certain degree

of helplessness with regard to man's external environment.

With the substitution of knowledge for ignorance in his field, and the growth of control, both actually achieved and realized by thought as possible, God is simply fading away as the Devil has faded before him, and the pantheons of the ancient world, and the nymphs and the local spirits.

"Peor and Baalim

Forsake their temples dim . . ."

Milton wrote of the fading of all the pagan gods; and now Milton's God is joining them in limbo. God has become more remote and more incomprehensible, and, most important of all, of less practical use to men and women who want guidance and consolation in living their lives. A faint trace of God, half metaphysical and half magic, still broods over our western world, but the growth of psychological knowledge will rub even that from the universe.

However—and this is vital—the fading of God does not mean the end of religion. God's disappearance is in the strictest sense of the word a theological process: and while theologies change, the religious impulses which gave them birth persist.

(To be continued.)

The Latest Work at Ur.

THE latest work at Ur of the Chaldees was described by Mr. Leonard Woolley in a lecture at the Royal Institution on May 11th. He said that the main object had been the elucidation and study of the earliest phases in the history of the site. The Ziggurat (the main religious monument of Ur) dates in its present form to about 2300 B.C., but was known to occupy the place of an earlier building presumably of the same character.

The excavators have now cleared the terrace on which the tower stands, and have laid bare the complete ground-plan of the temples which surrounded the Ziggurat of the time of the First Dynasty of Ur, c. 3000 B.C. These were themselves a later edition of temples founded at a considerably earlier date—the very beginning of the "plano-convex brick period"; and below the foundations of this second stratum we rediscovered remains of two still earlier periods, the later of which must belong to the "Jemdet Nasr" age. Here the work could not be carried to its logical conclusion, but at the south-eastern end of the Temenos area, excavations were carried down to virgin soil. The top strata revealed walls of Nebuchadnezzar's time, then houses of the Kassite age (c. 1400-1000

B.C.); below these was a cemetery of the Sargonic period (2600 B.C.), and below this a continuation of the older Royal Cemetery, falling within the fourth millennium B.C.

The graves of this cemetery excavated last winter were not rich but showed by their contents that this part of the graveyard was more or less reserved for soldiers; it was in one of their graves that the unique discovery was made of a stone statue of a woman placed as a funerary offering with the dead body. Below the Royal Cemetery came a stratum containing written tablets and seal-impressions on clay, of a much more archaic character than those of the Cemetery. At some depth below it appeared the graves of the "Jemdet Nasr" period, which were the principal object of the work.

Mr. Woolley said that the graves showed signs of marked cultural change and development; the more high-lying burials were later than the Jemdet Nasr age proper and contained "reserved slip" pottery and, in particular, an amazing wealth of stone vases. The lower graves were characterized by the presence of the three-colour painted pottery, as well as by plain burnished red ware and smoky grey pottery.



Summer in Finnish Lapland.

By F. J. North, D.Sc., F.G.S.

In recounting his impressions of a tour in Finland and Lapland, the author has some interesting comments to make on the effects of "civilization" on the primitive life and customs of the people.

WHEN Finland was a Grand Duchy of Russia, Russian and Norwegian territory lay beyond her northern frontiers, but when she became an independent republic after the Revolution of 1917-18 she pressed for access to the Arctic Ocean, and finally, by the Treaty of Dorpat (1920), received the Russian province of Petschenga. This is now the Finnish Petsamo, a narrow strip of land on either side of the Petsamonjoki, or Petsamo River, extending right to the Arctic Ocean, and including the whole of the Petsamo Fiord (see map). The name Petsamo is derived from the old Lappish name Baetsam, meaning fir, while the Finnish word *joki* corresponds to the Lappish *jok*, meaning river.

Although situated in latitude $69^{\circ} 40'$, about 350 miles north of Archangel and nearly 700 miles north

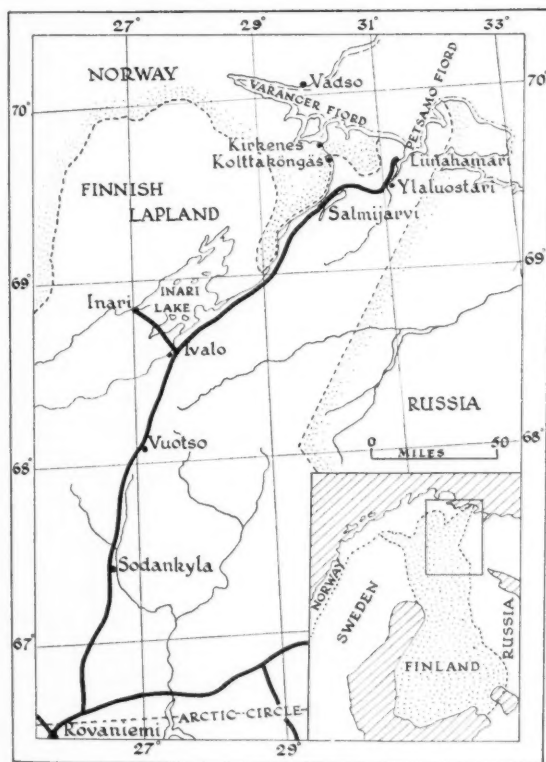
of Helsingfors (Helsinki), ports that for weeks in winter are ice-bound, the Petsamo Fiord remains open all the year round—hence its importance to Finland, because it provides an outlet for the produce of her northern provinces.

A deep-water harbour is being constructed at Liinahamari on the western shores of the Fiord, and all the way from Rovaniemi, at the railhead nearly 330 miles to the south, there has recently been completed a road on which motors can travel with speed and safety, although its surface consists mostly of loose gravel periodically smoothed over with wooden rakes or by means of a motor driven scraper. This road and the harbour at its end are, no doubt, destined to play an important part in the future economic development of Finland, especially when the mineral resources of Northern Lapland come to be developed. At present, however, it is used principally to maintain communication between the railhead and the settlers who have established themselves in Lapland, and to provide tourists with easy access to a region that has hitherto been closed except to those able and willing to undertake arduous journeys, and to live more or less as the natives do.

Forests and Rivers.

Although there are Lapp villages south of the watershed that separates the streams flowing southwards to the Gulf of Bothnia from those flowing northwards to the Arctic Ocean, scenically, southern Lapland is essentially a continuation of Finland proper. It is a region of forests, of large rivers and mossy swamps, with, here and there, farms and hamlets; for in this part of Europe the cultivation of rye and barley is possible considerably north of the Arctic Circle. The watershed is not an obvious mountain range but a series of rounded heights consisting of granitic and other crystalline rocks, smoothed by the passage of ice during the Glacial Period, after inconceivably long exposure to sub-aerial denudation. They extend well above the local tree-limit and the road rises gradually into a region of stony wastes—fjelds—on which the principal plants are lichens and creeping dwarf-shrubs, including, for example, the reticulated willow.

As one goes towards the north the sombreness of the dwindling forests of conifers gives place to the severity



Part of Finnish Lapland discussed by the author.

of the fjelds, but on descending the northern side of the divide, the scenery takes on a more "kindly" appearance than is presented anywhere in Finland except, perhaps, in the extreme south and south-west. The increasing abundance of birch imparts to the landscape a lighter tint of green, and the clear deep blue water of the larger rivers and the golden sandy banks of the inner curves of the meanders, suggest fragments of the sea coast of more southern climes.

Reindeer Moss.

North of the divide the "fjeld" condition descends gradually lower and lower until in the far north there are no trees at all. Fir trees disappear at about latitude 69° , and before doing so take on the shape that characterizes them in northern climes or high altitudes. In sheltered places the pine, getting smaller and less regular in growth, continues to within a dozen miles or so of the Arctic Ocean, and beyond that the only trees are birches which generally have a stunted and crippled appearance. Even these birches disappear from the higher ground before the Arctic coast is reached, but their northward limit is considerably extended in the valleys, as shown by the accompanying photographs taken in latitude $69^{\circ} 40'$. In the northern forests and on the fjelds there is an abundance of reindeer moss—species of *Cladina*—delicate dendritic growths that look (and in summer feel) something like pieces of loofah, pale greenish-grey in colour, and conveying the impression of an intangible glimmering surface. Right by the shore of the Arctic Ocean damp patches amidst the almost bare rocks may be carpeted with cotton grass (*Eriophorum*). Also in damp places there are sedges (*Carex*) which are gathered by the Lapps to provide a warm lining for their boots and gloves during the intense cold of winter. The grass-like plant is freed from seeds, is kneaded to break the fibres, and very carefully dried in the sun, small tufts being hung upon tripod-like erections of slender poles; when fully prepared it is a soft and absorbent insulating material, and at night, when in use, it is removed from the boots or the gloves, shaken out and dried.

Many of the Lapps, who were originally all nomads and are still under the necessity of moving about if reindeer keeping is their principal concern, have settled down in more or less permanent villages, usually by the side of a river or on the shores of a lake; fishing, cattle farming and agriculture of a primitive type are the chief occupations of the settled communities. There are about 2,500 Lapps in Finnish Lapland. When fishing is the principal occupation,

as in the settlements alongside tidal streams, scenes recalling, in miniature, those of the northern coasts of Norway greet the eye—and the nose! The fish are gutted and hung up to dry, while the heads are carefully preserved with a view to providing food for the sheep and the cattle to supplement the scanty supply of hay available during the winter. Strings of fish heads drying in the sun may be compared with the mountainous piles of similar objects on the quay sides in the Lofoten Islands and along the coast of Finmark.

The villages, as for example, Inari on the shore of the lake of that name, tend to become the social and economic centres of extensive districts. Except in the Petsamo area, where they nominally belong to the Orthodox Greek Church, the Lapps are mostly Lutherans and take their religion seriously, and from time to time, especially at Christmas and Easter, they travel considerable distances to attend the services. On this account, the churches often seem out of all proportion too large for the villages in which they are situated, but at festival time they are much too small to accommodate those desirous of entering.

For the most part the dress of the village Lapps resembles that of the ordinary Finnish peasant, and the picturesque costume usually associated with the Lapps is not often seen during the summer months; high boots with turned up toes are generally worn, but they are not necessarily of home manufacture as in former days, because machine made goods have penetrated wherever the road extends, and itinerant vendors occasionally visit even the extreme northern villages. While the opening up of the country by the construction of roads and the introduction of motor boats facilitates travel, its inevitable concomitants—the decay of primitive customs and the sophistication of the natives—are already only too apparent in the settlements. The summer visitor rarely has the opportunity of seeing the Lapp at his best, that is, when he tends and follows his herds of reindeer as they seek their food beneath the snows of winter.

Origin of the Finns.

Since much of the country is made up of crystalline rocks overlain by gravels of glacial origin in which surface water collects, most of the wells in Lapland (and indeed in Finland also) are comparatively shallow, and the usual means of raising water is by means of a long pole with a bucket and counterpoise, similar to the shadoofs used, for example, in Egypt and in Hungary. This is a matter that may have ethnographical significance, since the Finns are supposed

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Petsamo Fiord, beyond the limit of birch trees.



Kolttakongas village, a picturesque collection of buts.



Monks drying hay in a meadow at Ylaluostari.



A Lapp cottage, showing the rack for drying grass for boots.

to have come originally from the east and to have racial affinities with the Magyars, whose language theirs in some ways resembles.

There are many prosperous farms in southern Lapland. The houses and outbuildings are low and are usually arranged so as to enclose a grassy courtyard. They are built of more or less roughly squared logs notched at the ends, and are often painted brick red, with the window frames picked out in white. The summer is so short that great care has to be taken in the drying of hay or of cereals; this is effected by methods similar to those adopted in Norway and in the meadows of Alpine regions. The hay, or the barley in small bundles, is either impaled upon single upright poles placed at regular intervals in the field, or is piled in a wall-like fashion on tall closely arranged stems of coniferous trees. The latter method is illustrated above, the monks of the former Russian monastery of Ylaluostari being seen at work in their meadow. This is a beautiful grassy area that has been reclaimed since the saintly monk Trifon

formed a monastery here in the sixteenth century; it is situated on latitude $60^{\circ} 30'$ —that is, nearly 400 miles north of Reykjavik, the capital of Iceland, and as near to the Pole as the north coast of Alaska—evidence of the geniality of the summer in Finnish Lapland. For months the land is frostbound, but the brevity of the summer is compensated for by the continuity of the daylight, for the sun does not set for several weeks, and even in August when it goes below the horizon for some hours, the nights are not really dark. Soon after sunset the landscape is bathed in a strange pale light derived from no obvious source; distant objects stand out with remarkable clearness, until, soon after midnight, the sun begins to rise again.

The Monk Trifon also established a church by the side of Patsjoki, a river that flows into Varanger Fiord. The site was sacred to the memory of two Christian Princes, Boris and Gleb, who were murdered there early in the ninth century. Around the church there grew up a village called Boris-Gleb inhabited by Skolt-Lapps; since the Finnish occupation its name

has been Kolttaköngäs after the rapids situated a kilometre or so to the south. The village is a collection of wooden huts irregularly arranged on a grassy plain by the side of the river; each has its own small patch of land, its rack for drying hay and its tripod for drying the carex "grass." Near by are the store huts for the accommodation of such things as hay, reindeer skins, and fishing tackle, and in which, during the summer months, some members of the family will sleep. The huts, like the hay huts in alpine meadows, are raised from the ground for protection against damp.

The principal occupations of the inhabitants, of whom there are between 50 and 60, are fishing and reindeer breeding, but they also keep a few sheep and add to their incomes by acting as boatmen for foreigners who come to fish. The people do not seem to have been improved by their settled existence and their contact with the outside world, for they are of poor physique and are thriftless, spending freely what they gain in summer and suffering privation in winter. The Finnish Government seeks to improve their condition by providing work on the roads or in connexion with the lumbering industry, which is important even in this northern region. Logs from the forests further south are allowed to float down the streams to the great sawmills near the coast, and one of the most interesting of river sights in Lapland, and in Finland too, is the breaking up of a log-jam by the lumbermen whose duty it is to keep the logs on the move.

Although nominally Christians, the Lapps retain some of their pagan customs; this was seen in the case of graves dug in the shallow soil of the birch woods near Kolttaköngäs. In spite of a cross and Christian inscription, there have been placed on some of them the axes and paddle of the deceased, against the time when he will need them in the spirit world; and yet, from the graveyard, one could see the Lapp folk, who, in the long course of events, will be buried there with similar rites, buying factory made clothing, tunics with "zip" fasteners, and machine sewn boots!

Of the many impressions gained during a tour in Finland and Lapland, two seem to stand out more clearly than the rest—they are (a) that the popular conceptions of Lapland are usually based upon the conditions that obtain in winter, for the summer, though short, reveals a hospitable country of great natural beauty, and (b) that although the Lapps are not decreasing in numbers, the tendency is for their mode of life to approximate to that of the peasantry of the land in which they live. The standardization and the loss of original traits that ensue when a country is "opened up" are already noticeable even in this remote region. Fortunately, however, the Finns are alive to the necessity for preserving records of these disappearing cultures, and in their National Museum in Helsingfors and in the open air museum on the nearby island of Seurasaari, the life of the Lapp communities is admirably portrayed.

New Geographic Expeditions.

The Board of Trustees of the National Geographic Society, Washington, has decided to take part in three important expeditions this summer. The details given below are reproduced from the "National Geographic Magazine."

THE National Geographic Society, which was founded for "the increase and diffusion of geographic knowledge," has organized and assisted many expeditions during the past forty-six years. Among its most spectacular achievements have been the researches on the world's biggest crater, Mt. Katmai, in Alaska, which were begun soon after the terrific eruption of 1912. It was in this vicinity that the vast area of steaming spouting fissures known as "The Valley of Ten Thousand Smokes" was discovered, and a further expedition to Alaska is among the new projects which the Society has decided to support this summer. According to details just published, these explorations will involve some of the oldest and also some of the most modern vehicles that man has used in his effort to explore his world—a diving sphere to reach abyssal

ocean depths; dog teams to map obscure Alaskan areas, canoes to help solve mysteries of giant volcano craters, and aeroplanes to fly over Antarctic wastes.

Because the depths of the ocean offer rich returns in the field of geographic research, the Board has authorized a grant of funds to Dr. William Beebe to enable him to resume deep-sea explorations during the coming summer. He plans to descend to unexplored depths inside the heavy steel ball (the bathysphere) in which he previously made the record descent for a living man—2,200 feet.

This unique diving sphere is four-and-a-half feet in diameter, with a shell one-and-a-half inches thick, and weighs two tons. It has windows of fused quartz fashioned to withstand the tons of pressure from sea

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water. Through the windows beams of light will penetrate the water, and thus the strange creatures of the ocean depths will be observed. A steel cable will lower the sphere from a barge at the surface, and rubber-enclosed wires will afford telephone communication and current for electric lights. Dr. Beebe will have a telephone transmitter held by an arm in front of his mouth and will dictate descriptions of what he sees to an assistant on a barge above.

During Dr. Beebe's descents in 1930 and 1932 many strange creatures were discovered. Some had glowing and flashing light organs which help them in their battle for life in the weird blue-black depths. The explorer expects to find new specimens this year. With the aid of additional apparatus, it is hoped to prolong the dives to four or five hours, so that detailed observations can be made of the unknown activities and habits of deep-sea creatures off Bermuda.

Volcanic Secrets.

The National Geographic Society will also co-operate with Father Bernard R. Hubbard, S.J., in the exploration and mapping of the volcano-torn Alaska Peninsula and the adjacent Aleutian Islands during the summer. The best map of the region is 25 years old, and many large districts have not been mapped. Some of the greatest volcanic eruptions of historic times have since occurred in the area and have materially altered the relief and the drainage.

The new expedition will use an aeroplane to reconnoitre and make aerial photographs, and will then use pack dogs for work on the ground. Canoes will be taken down into the craters of Katmai and Aniakhak volcanoes, so that soundings and water temperature studies may be made of the lakes that lie in bottoms of the huge pits. Vents in the floors and walls of craters will be observed to collect data bearing upon the cycles of activity in this important volcanic region. These studies may make possible the forecasting of eruptions. The aeroplane will fly over and photograph the famous "Valley of Ten Thousand Smokes." Fifty thousand feet of standard motion-picture film will be exposed and 4,000 still photographs will be taken. By means of a portable army wireless set weekly reports will be sent out. The party left for Alaska in May and will return in September.

Lastly, it is announced that the Society will contribute \$10,000 to the Antarctic Expedition of Rear-Admiral Richard E. Byrd. After carrying on preparatory and reconnaissance work during the summer and autumn, Admiral Byrd will winter near the shore of the Ross Sea. When the summer of the

Southern Hemisphere approaches, next November, he plans to fly to the South Pole, and he will make geographic explorations by air into other areas on the continent. A varied programme of geographic projects will keep his staff of technical assistants busy. Studies will be made of the aurora australis by photographs and colour intensity apparatus. Efforts will be made to learn more about the mysterious cosmic rays. Their intensity has already been noted at intervals during the voyage from the United States, and comparative records will be obtained at "Little America," high on the polar plateau, and at a point as near as possible to the South Magnetic Pole.

Is the South Pole "Afloat"?

By using explosives and recording reflected and refracted vibrations, geophysicists of the expedition will probe beneath the thick mantle of ice to find what parts of the Antarctic regions are land and what part "water." It is even considered possible that the vast polar plateau, more than 9,000 feet high, may be a huge stationary glacier, built up through ages in a sea surrounded by mountains.

In the sea near "Little America" the expedition will work at problems of biology. Wherever outcrops of stone occur, geological investigations will be made, with special effort to collect fossils, from which can be pieced together the story of Antarctica's past. Ice movements will be noted; and there will be studies of gravity, magnetism, weather conditions, light, meteors, earth vibrations, and radio performance. Equipment of the expedition will be observed to determine the effects of cold on the elasticity of materials.

The Society's Magazine also reports that Capt. Albert W. Stevens, of the United States Army Air Corps, has been chosen by the Board of Trustees to receive the Franklin L. Burr Prize of \$1,000 for his accomplishments in the technical field of aerial photography on National Geographic Society expeditions. The prize was given particularly for his achievement in obtaining aerial photographs showing the moon's shadow on the earth. The photographs were made during the eclipse of the sun of August 31, 1932, from an altitude of more than 26,000 feet.

Another important achievement of Capt. Stevens mentioned in the award was the taking from a high altitude of the first photographs showing laterally the curvature of the earth. The Burr Prize was established under the bequest of the late Mary C. Burr, of Hartford, Connecticut, who bequeathed a fund of \$35,000 to the National Geographic Society in memory of her father.

In the Byways of Japan.

By E. H. Anstice.

A reader in Shanghai sends us this account of a holiday in a corner of Japan that is seldom visited by orthodox tourists. In a few days, he says, the traveller may see more of the real life of Japan than in weeks at the usual tourist centres.

THE average visitor to Japan confines his attentions to two districts—that around Tokyo, comprising Nikko, Fuji-San and Kamakura, and that embracing Kyoto and Nara—dashing from one to the other in the comparative isolation of the observation and restaurant cars of the Tokkaido express. But there is another way of making the connexion by means of a detour round the western coast through the Hokuriku district and its chief city, Kanazawa. For those who can spare the time and afford the small extra expense, it is well worth venturing to this extent off the beaten track. Twelve hours by express through the heart of the Japanese Alps and then along the coast will bring him to Kanazawa, and thence another ten hours in a leisurely stopping train—unless he is foolish enough to prefer the stuffiness of the night express—will deliver him at Kyoto.

Kanazawa, "City of the Golden Pool," is situated on the Japan Sea coast of Japan at the base of the Noto peninsula. Standing some four miles from the sea it straggles over a narrow spur running out from the mountains which surround it on three sides and across the two rivers whose valleys this spur divides. From the scenic point of view the situation is perfect. Landwards the valleys run back into the encircling hills, with behind the peaks of the Japan Alps reaching up till their snow-clad summits seem to merge into the sky. In front a carpet stretches to the sea, in winter of snow and at other seasons of green or yellowing rice.

Under the Shogunate Kanazawa was the seat of the greatest of the feudal lords, the Daimyo Maeda. It was granted to this family by the first of the Shoguns in the sixteenth century. The shell of their castle still remains dominating the town from its position on a detached knoll at the tip of the spur which gave the town its original name—O-Yama, "Mountain-tail

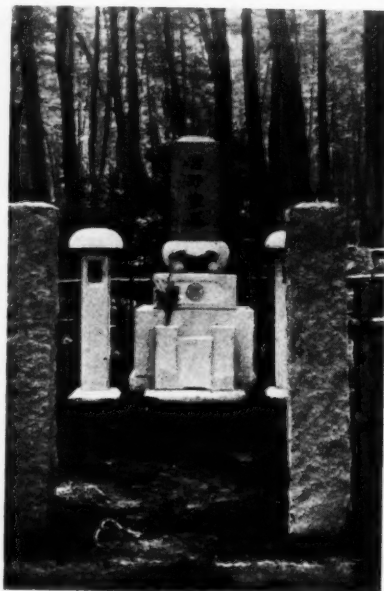
City." The park which the first Maeda made is now public property and is a masterpiece of the Japanese landscape gardener's art. The story goes that its creator was put to death by his employer lest he reproduce it elsewhere. It is a masterpiece also of the

art of topographical allusion, as there is a hidden reference to the classics in the setting of each stone, and the arrangement of every tree, bridge and stream. But for the foreigner its sheer beauty is enough, whether in the autumn when gorgeous with the reddening maples, or in the spring, first ablaze with azaleas and a little later one resplendent mist of cherry blossom.

In a shady corner, carefully fenced round, is the "golden pool" from which the town obtained its present name. A pious youth, so the story goes, offered one day to wash the vegetables for his mother, and on doing so in this spring the carrots and potatoes were turned to lumps of gold in his hand.

Even more interesting, perhaps, is the forest graveyard, almost unique of its kind, which stretches over the slopes of the neighbouring

hills of Nodayama and Daijōjiyama. One drives out to it through a street of temples and past rice fields to the entrance at the foot of pine, fir and cedar clad hills. A path leads up into the dim coolness of the forest, and among the trees and undergrowth can be seen the moss-grown tombs of the city's bygone dead. On the lower slopes are those of farmers and merchants, above them lie the *samurai*, and then one passes through a gate in a palisade and climbs a seemingly endless flight of earthen steps to the summit where the Maeda ancestors are buried. Each has his own enclosure and *torii*, except in the case of women and children, when one enclosure has to serve for two or three. Yet the highest mound of all and the oldest is a woman's. The wife of the first Maeda lord was a daughter of the Shogun's house,



A tomb in the forest graveyard on Nodayama, Kanazawa.

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and on her death a burial place suited to her dignity had to be found. The summit of this hill provided it.

Not all the Maedas are buried here. At the other end of the town behind one of its oldest temples are other burial mounds. Here again the largest is a woman's, containing the wife of a later Maeda. One day she revealed to her husband the fact that she had been married to him by her father, a rival lord, to be the instrument of his ambition—she was expected to kill him. But her wifely love would not allow her to obey her father's commands, and since she could not continue to live an unfilial daughter, suicide was the only one thing left to her. Her husband buried her in the grounds of this temple which he built and endowed in her honour.

The whole neighbourhood is full of reminders of the Maeda overlordship. In Kanazawa itself the street names constantly bring back the past. There is Taka-jo machi, "Street of the Falconers," where the hawksmen lived. It leads into Ishi-biki cho, "Stone-drawing Street," through which the stones were carted from the mountains to build the castle. The descendants of the builder still live in that castle's shadow. Thirty miles away at Takaoka, the chief street is lined with cherry trees and is known as Sakurababa-cho. At one time it was the Maedas' race-course. The most enduring memorial, however, is the Kutani porcelain industry which they introduced, importing artisans to teach the natives of the district. Kutani is one of Japan's three chief ceramics.

From Kanazawa a trip can be made into the Noto peninsula, the backwoods of Japan. The railway runs out to the little port of Nanao, and thence it takes about six hours by steamer, through a miniature



Fish trap with watch tower from which a look-out is kept for incoming shoals.

inland sea, to Iida at the tip of the promontory. In rough weather only hardened sailors should attempt the voyage, for the small steamer is small indeed and the accommodation rather primitive. But if it is fine the trip should not be missed. The boat hugs the land all the way, dodging in and out islands and every now and then popping into some tiny, land-locked harbour where the scene is full of interest, though the smell, to those unaccustomed to it, is often vile! Nearly every house is festooned with strings of dried or decaying fish to be used later as fertilizer.

From Iida the return journey can be made by land, first to Usitsu, and then to Wajima at the other side of the peninsula. The roads, though poor, are possible for motoring and lead through some of the finest scenery in Japan. One stretch along the cliffs into Wajima is unrivalled for its combination of mountain and sea, though the narrow unfenced track is not for those with weak nerves, with its hairpin bends, corkscrew turns, and bridges set at right angles over ravines and sheer drops of hundreds of feet to the shore.

At places the road descends right to sea level to give a nearer view of the fish traps which punctuate the shallow waters all along the shore. A portion of the sea about 40 yards by 20 is enclosed by nets with an opening left at one end, from which a guide net stretches out about 300 yards into deep water. By each trap is a watch tower from which an observer keeps a look-out, and as soon as an incoming shoal has entered the trap he closes it, and summons his fellow-fishermen from the shore. In a couple of boats they pass up the trap, hauling in the net and



House building at Kanazawa is accompanied by singing and feasting.

passing the cleared portion behind them under the boats, until the main body of the catch has been driven to one corner. After that the rest is easy.

Wajima produces some of the best lacquer in Japan. Here the old tradition of individual craftsmanship still survives. The very best is turned out by one man firms, in which the craft has been handed down for generations, and these would rather lose an order than turn out hurried and unworthy work. In one quarter of the town there resides, too, a little community in which the women are the breadwinners. They go out diving for shells, used in lacquer ornamentation, while the men stay at home and do the housework. Nearby, again, are villages whose inhabitants in summer migrate *en bloc*, priest, school-master and all, to the islands off the coast where they spend their time fishing.

A Changing Panorama.

In the few extra days this Hokuriku trip occupies, the traveller will see more of the Japanese and the real Japan than in weeks at the ports and the usual tourist centres. On the train he will be travelling with the people of the country, as there are no restaurant or observation cars on this route, and some of whom are sure to get into conversation with him, even if in somewhat limited English. There will be many stops at typical Japanese railway stations, and an ever-changing panorama of the countryside. At Kanazawa he will have to put up at a Japanese style hotel, as also at Wajima, or wherever he chooses to break his trip through Noto.

Indeed, one of the greatest charms of Hokuriku is that it is as yet comparatively untouched by the veneer of westernization which is overlaying Tokyo and her sister cities. The *kimono* is still the ordinary garb of men as well as women, the architecture is Japanese architecture, and amusements the traditional amusements. Old habits and manners still survive as part and parcel of the people's daily lives. The peasants still cultivate the land as they did a hundred years ago, wearing the same straw costume, using the same tools and methods; houses are built in the ancient style, of the same materials and with the same ceremonies. The visitor, as likely as not, will meet on his walks a gang of women chanting as they beat flat the site of a house with a primitive pile driver, while at night he may happen on a later stage in house construction. When the roof tree has been hoisted into position, the workers kindle a fire in the skeleton building and feast round it, singing and generally making merry.

Again, as he walks down a street, he may see the

sign of the black hand on a door post, and be told on enquiry that it is a charm to cure a child's whooping cough. When ninety-nine people have passed by the cough will have gone. He may even meet some old woman from the mountains with the black lacquered teeth that olden custom demanded.

It must be admitted that there are obstacles to be overcome. Care must be taken not to set out on the railway journeys without a plentiful supply of refreshment. The *bento*, consisting of a box of cooked rice and another of oddments of fish and vegetables, which takes the place of the luncheon basket for the Japanese, is not likely to appeal to the taste of the foreign visitor. Then there is the language difficulty. But that is not insuperable, though it would certainly be foolish to venture into the comparative wilds of Noto without a guide. However, the small foreign community at Kanazawa has always a ready welcome for the infrequent visitor, and will readily arrange this for him. And always and above all there are the Japanese people, simple, friendly, kindly, willing to help in any way they possibly can. There is nothing that should frighten him away, but much that should attract the traveller who penetrates into these byways of Japan.

The Sinai Codex.

WHILE the May issue of *Discovery* was in the press, the Editor received a letter from the Archbishop of Canterbury commending further support for the purchase of Sinai Codex. The letter explained that the appeal issued by the Trustees of the British Museum for £50,000, to be met by a similar amount offered by the Government, had now achieved its object, more than £46,000 having been received from the public.

A strong desire, however, had been expressed in many quarters that although the offer of the Government to render secure the acquisition by the nation of so great a treasure is recognized to have been both generous and right, further opportunity should be given to raise as much as possible of the total sum of £100,000 by the voluntary efforts of all who reverence the Bible.

Accordingly, leaders of Christian Churches in this country are now issuing the appeal for this purpose which the Trustees are most ready to encourage and support. The Director of the Museum will continue as before to receive and acknowledge all contributions. To meet the convenience of the Government, it will be necessary to close the list some time before the end of the present session of Parliament. It is therefore desirable that contributions should be sent in as soon as possible.

The Place of the Expert in Modern Life.

By. T. E. Gregory.

Cassel Professor of Banking in the University of London.

By special permission of the Editor of "The Independent," we reproduce the following article, which, though dealing primarily with the expert in the realm of economics, is equally applicable to all spheres of modern thought and activity.

IT is said that when at Versailles in 1919 some particularly questionable paragraph or proposal was being debated by the politicians, the doubters could always be brought into line by the assurance that "Tous les experts sont d'accord"—all the experts are agreed; though I leave it to the reader to decide whether the point of the story lies in its assumption of the superior iniquity of politicians exploiting the simple innocence of the highly trained or in the assumption that any group of experts could be got to agree upon anything whatever. But the place of the expert in the life of to-day is a matter of the very highest importance: the decline of popular government on the one hand and the enormous complexity of the issues to be faced on the other (factors which are, of course, intimately connected) make it imperative that we should all of us have as clear an idea as the circumstances permit of what we expect the expert to do for us, and what the expert can demand from the society of which he is a part. In this country a very healthy tradition dictates an attitude of scepticism; we have always, in the past, preferred the amateur to the professional status, not least in matters of government. Were we right, or shall we abandon our tradition in these matters and entrust our future to the "trained intellect" as we are increasingly abandoning the idea that we can compete with the expert in golf or tennis or bridge?

Knowledge and Judgment.

The gibe that an expert is a person who knows more and more about less and less carries a warning with it, which we should do well not to neglect. Knowledge and judgment are two very different things, and all that an expert can lay claim to, in that particular capacity, is knowledge: but knowledge of what? The statesman and the man in the street are enormously inferior in their stock of knowledge of particular points, but each particular expert is only superior to them on one point; even if his judgment concerning matters coming within the sphere of his special competence is unquestionable, this throws no light whatever upon his judgment in general. (Paradoxically enough, the world is inclined to take experts at their own valuation, and to assume that because a man knows everything about a particular subject that fact justifies an expression of opinion on all sorts of other matters as well. So the

opinions of eminent chemists on currency questions or issues of social reorganization are given an importance which they by no means deserve; on all questions, except upon those to which an expert has devoted his life, his opinion is no more worth having than that of any one else of an equal grade of general ability. Perhaps it is worthless, for there can be no question that absorption in one particular field tends to give a man rather a biased outlook upon more general problems. (At any rate, this much is clear: the expert is only capable of giving opinions within the special field of his own *expertise*, and the exploitation of special reputations in the interest of this or that issue, with which that special reputation may have nothing to do, is an *abuse*.)

Significant Issues.

There are other features of the intellectual life of the expert which, again, should warn one against over-reliance on his judgment. The first is the age-long tendency of experts to stress, not the points of agreement, but the points of disagreement with colleagues: whatever one knows, and what every one subscribes to, is not "news" in the scientific any more than it is in the journalistic world. "Where there are six economists there are seven opinions, and two of them are J. M. Keynes's," is a charge very often brought against experts who happen to be economists. The truth is that very much the same state of affairs appears to prevail in medicine, theology, law, and even in the "pure" sciences. It is not that there is not a common element of belief and knowledge: on most questions the six economists would, no doubt, be prepared to agree. Unfortunately, it happens that the issues upon which they disagree are the ones which are practically the most significant. It follows from this that to allow practical problems to be solved by "experts" is tantamount to saying that they will not be solved at all; and a statesman who tries to shake off responsibility by saying that he has "left it to the experts to decide" is simply implying that he is trying to shelve a difficult problem indefinitely, or that he is putting the moral responsibility upon "expert" shoulders—the "expert" in this particular case being simply a man who thinks as the particular statesman in question thinks upon a given issue. And there is this further

point, which those of us who live in familiar contact with experts have brought home to us in very intimate fashion: the more one knows about a particular subject, the less inclined one is to "plump" for one particular solution rather than another. It is a hateful position to be in: one is asked about the choice between, say, a managed currency and the gold standard. A whole crop of special points and difficulties about which the layman cares nothing immediately springs to mind; one mentions them and the only reward one gets is a polite remark to the effect that "Of course you experts love making things look more difficult than they really are. Why not get down to brass tacks and tell us what we ought to do?" If experts only could!

The Ultimate Choice.

But, in fact, when it gets to making the ultimate choice, *expertise* breaks down; for it is only in rare cases that it is so obvious what ought to be done that no intellectual difficulty arises. And those cases are either those which interest nobody or those cases in which expert opinion is so opposed to what the average man really wants that he refuses to listen. For, as far as I can see, it is not when the average man knows what he really wants that he consults the expert: it is when he is in doubt that he runs to someone who is supposed to know "all about it"; even if expert opinion is unanimous, the gulf between unconscious expectation and the expert answer is so great that no attention is paid to the expert answer. Questions of currency policy apart, I doubt whether it would be possible to find a dozen reputable economists, in those countries in which respect for the laws of responsible thinking still leave room for a fairly unbiased opinion, who would not regard the trend of current economic policy with horror; the impotence of economists is not a measure of their disagreements in this particular case, but a measure solely of the unwillingness of people to listen to them. Unfortunates that we are: when we disagree it is made a point against us; when we agree we are dismissed because "it may be all right in theory, don't you know, but it won't work in practice."

The Problem of Values.

And yet the world is a complicated place; there are terrific problems to be solved, and if the expert cannot solve them, who can? I believe that the place of the expert in modern life can be made a much more unambiguous one, and the services he can render be made much more fruitful of results, if the following very simple but, I believe, fundamental truths can be borne in mind. Firstly, that the tendency on the part

of the expert to exaggerate the importance of his own solution of a particular problem and, secondly, his tendency to exaggerate the importance of his own particular subject is frankly faced, so that due allowance can be made for the personal equation. Thirdly, it is all-important to remember that all science deals, not with ends, but with means. One of the great services which Mr. H. G. Wells rendered to clear thinking in earlier days was to dispose, for instance, of the claims of the eugenists by showing that the definition of the "ideal man" was a matter of ethical and other *values*, rather than of scientific *fact*. An expert can tell you, perhaps, the best way of arriving at a particular result, but whether the result is worth having is a matter about which he is no more competent to judge than any one else. Lastly, but by no means least, no expert can throw any light *at all* upon what is, after all, the fundamental problem of government and of life in general—the *order* of values. "First things first"—but what things are first? Upon that we all differ, and the experts differ among themselves at least as much as any one else. In the end let us recognize that the craze for "leaving it to the experts to decide" is merely another and more polite synonym for refusal to face the problems ourselves. If the experts are wise, they will refuse to accept any such impossible task—but, then, are the experts wise?

World's Largest Telescope.

A TELESCOPE claimed to be the largest in the world is now being constructed in the United States. It will cost \$6,000,000, including an observatory building and laboratory, and is being built for the California Institute of Technology, to be erected on a mountain top near Pasadena. According to *Popular Science* (New York) it will be ten times more powerful than any telescope now in use, and the most expensive scientific instrument ever built. It is expected to open up thirty times the volume of space hitherto observed, reveal millions of new stars and star clusters, and help solve some of the problems that have puzzled astronomers for centuries.

The production of flawless discs of glass for such mirrors has taxed the utmost abilities of glass makers. The disc of a sixty-inch mirror must be eight inches thick and weighs a ton. The 100-inch mirror of the Hooker telescope, at Mount Wilson, is thirteen inches thick and weighs nearly five tons. The glass disc for the 200-inch mirror is nearly thirty inches thick and weighs approximately twenty tons. It is four times larger than the biggest mass of glass hitherto poured into a single mould.

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Tree-Nesting Merlins.

By E. W. Hendy.

(Author of "The Lure of Bird-Watching," etc.)

Merlins normally lay their eggs in a hollow on the ground, but the author has discovered a locality where these interesting birds nest in trees. He speculates on the origin and possible outcome of this change in habit.

I WAS once in a cinema when the next film announced was "Merlins at Their Nest." An individual sitting behind me asked his companion, "What is a merlin?" "I think it's a snake," was the reply; I could not help turning round and saying, "No, it's a bird."

This moorland falcon, the smallest of our native species, usually lays its eggs in a slight hollow or scrape upon the ground. But in a certain district which I have known for a number of years, merlins nearly always choose the old nest of a magpie or carrion crow as a nesting place. Often the nest chosen is situated not more than ten feet from the ground, though occasionally one as high as thirty or forty feet may be selected. Perhaps for purposes of concealment, a nest in a tree growing near the bottom of a combe, and so invisible from the surrounding country, is usually preferred.

Merlins who make their nest in a tree so situated are easy to observe, for a watcher, crouching among the heathery side of the combe, is on a level with, or even above the incubating bird, and the hen merlin is a very tame sitter. Last summer I and many other bird-lovers watched for hours, at a distance of only twenty yards, a female brooding her eggs in an old grass-grown crow's nest, some eight feet high in an ancient thorn. As we watched she held us with her large, dark eye, but never stirred an inch. Field-glasses revealed every feather, her mottled buff and brown mantle and barred tail, her yellow cere and bluish beak. Once only we found the jack merlin brooding; shaded by the foliage, the sheen of his plumage was dulled, but when, less tolerant of our presence than his mate, he took to flight, his slate-blue wings gleamed almost azure in the bright sunlight.

Incubation.

Merlins incubate for nearly thirty days; even without putting the hen off the nest you can tell when the young are hatched by the way she ruffles out her wings over them. At first the nestlings' coat is of white down, but soon a longer, darker down replaces this, and beneath it the feathers begin to sprout. At this stage, when about fourteen days old, the youngsters are queer, owl-like creatures. The

tail and wing feathers are well grown, but there are tufts of greyish down still adhering to the head and back which give them an unkempt, half-clothed appearance.

At this time the jack merlin does most of the hunting; he brings the prey to some spot not far from the nest and calls to the hen who flies to him; he passes the kill to her in the air, and she takes it to the plucking place—this may be either a mound or old mole hill; there were a dozen of these on the combe-side near one nest I watched, and they were littered with the feathers of skylarks, meadow pipits and whinchats; rarer victims were a blue tit and a redstart, and you may find feathers of birds as large as a blackbird. Other merlins prefer a tree branch, or stump or rock as a shambles; but never have I found any trace of grouse, even on a grouse moor. Castings show that beetles are also taken.

Feeding Habits.

The young merlins remain in the nest for about twenty-five days, but when fledged they still keep near the nesting site for a fortnight or three weeks. During this period they are fed by the parents. They soon learn to take the prey from the old birds in the air, though sometimes they fail at the first attempt to hold it as it falls. I have watched the jack merlin bring food to the young in this way on several occasions, though this does not seem to have been noticed by other observers. Sometimes the old birds bring the kill to the nest and leave it there.

It is interesting to speculate on the origin of the tree-nesting habit in merlins. Outside the district I have mentioned it seems to be exceptional. In so far as it protects the eggs and young from ground-haunting enemies, it works for the survival of the species. But a tree nest, especially when it holds young in white down, is easily discovered by man. Merlins are courageous in defending eggs or young from intruders; I have seen them drive off herons, ravens and crows, and I have no doubt they would tackle a stoat, a hedgehog, or an adder. But badgers are said to eat eggs and nestlings; they and also foxes are common in the tree-nesting merlins' country, and I fear that even those brave little hawks would be unable to repel a raid by so formidable a marauder as Reynard or Brock.

It is possible that security from such enemies explains the origin of this arboreal nesting in certain localities. If efficacious, this habit would in time produce a strain of birds who preferred a tree nest, and eventually the custom would become universal with their descendants.

Book Reviews.

The Great Design. Edited by FRANCES MASON. Introduction by SIR J. A. THOMSON. (Duckworth. 8s. 6d.).

This is a popular book of science of an unusual character, and its distinguishing feature certainly gives it an advantage. Fourteen well-known men of science were asked by Mrs. Frances Mason, author of "Creation by Evolution," to contribute to a symposium under the title given above, which is analysed on the cover into the questions, "Is the World a Soulless Mechanism?" "Is it a work of blind chance?" "Is Materialism true?" It was a happy thought, subject to the one great drawback which shall be mentioned below. It led each contributor to limit his remarks and focus them more or less round the main subject proposed; it also adds to the interest of the reader who goes on eagerly in order to find out where the author stands in relation to the great questions propounded by the editor. Some of the writers, as one might expect, do not commit themselves very definitely to any general belief as a result of their particular observations, and of these one ought to signalize Dr. Stuart Gager, of the Brooklyn Botanic Gardens, both for an extremely careful and interesting article on Adaptations in the Plant World and for summing up his conclusions with marked balance and independence of judgment.

"I have not," he says, "set out to attempt a definite answer to the question of whether there is 'mind-back-of-it-all,' but only to set forth the kind of facts and certain considerations which must be weighed if one wishes to face the question with his reason as well as with his emotions. . . . If all the cases of adaptation in the world were tabulated and by some miracle could be in our consciousness at once, we should not have any greater argument for mind behind 'Nature' than if we merely contemplated space, or time, or gravity. . . . We are still left face to face with the problem, not only of how the machine works, but of what makes it work. Analysing it down to electrons and protons, the building stones of the universe, leaves us as far from the ultimate solution as when we confront plants and their environment. . . . Shall we attempt to explain machines electrically, or shall we attempt to explain electricity mechanically? Neither alternative gives intellectual satisfaction, and the idea of 'mind behind—and within—it all' seems as rational a working hypothesis as any."

Some of the other Transatlantic contributors, especially Dr. Maynard Metcalf, of Johns Hopkins, and Dr. Aitken, of the Lick Observatory, and Dr. Eve, of McGill, stand out pre-eminent in the volume for the freshness and vigour of their chapters. The English contributors in comparison give one the impression of singing an oft-repeated song. Some remarks at the end of Dr. Metcalf's paper deserve quotation, as they lead up to the great lack in the volume to which allusion was made above. "I was asked by the editor to discuss the evidence of intelligence, adaptation and purpose in Nature as found among animals, doubtless for the reason that I have been a student of animals. I have, however, confessed the inadequacy of such evidence, if man be not taken into the picture. But man is in the picture, very much in the picture, and man is an animal, a product of Nature, and, of course, in consequence, is consistent with Nature. In him, just as truly as in an amoeba or a rock or a star, Nature reveals herself. . . . Man's capacity to appreciate beauty and duty is as natural as is any other part of him . . . and as I see Nature, her spiritual (personal) aspects are those which reveal her most intimately, tell of her purpose, make legitimate

the search for an answer to the question, Why? as well as to the question, How? *Man himself is why, so far as he goes!*"

The last compendious remark is almost the only approach to a philosophic view which the book contains; and this is the obvious lacuna to which reference was made above. All the various observations, of wonder, of immensity, of adaptation, with the thoughts which they suggest to the various writers, need to be weighed, criticized, correlated, especially with reference to the human mind which has made them. This is the work of the philosopher. Mrs. Mason has given us the observations and the *obiter dicta* of a number of men of science. They would form admirable raw material for a philosophic treatise which need not be either too long or too difficult, on the questions propounded. We would suggest either Professor Broad, of Cambridge, or Schiller or J. A. Smith, of Oxford, or the nation's Laureate for philosophy, Samuel Alexander, O.M., of Manchester.

Jungle Memories. By HENRY H. RUSBY. (McGraw-Hill. 12s. 6d.).

Dr. Rusby is an exceedingly lucky man. Whether in hair-breadth escapes from rapids or lightning, or exchanging money, or looking for old editions, luck is always on his side. At the same time, the reader has an uneasy feeling of anti-climax when he finds cheques. That is the plant to find which he had travelled all the way to Chile; there he had a thousand miles in which to seek it, twenty thousand species among which to find it, yet the very afternoon of his arrival he found it staring him in the face in the hotel garden. Even yet his luck did not desert him, for when he needed a thing so unusual as a powerful hand-press, there it was at his neighbours. But we must not be envious, for Dr. Rusby is a scientific and dauntless explorer, with tact, perseverance and knowledge. Where we all may envy him with justification is in his fortune to have found scope for his tastes and talents in spending so many years exploring the unending flora of the Neotropical Region.

We must be grateful, too, for now he has given us a book of a naturalist's travel which brings up memories of Darwin, of Wallace, of Bates, and of Belt, so full of interesting observations that selection for quotation is difficult indeed. The forest must be the despair of the botanist, where there are as many as seventy or more parasites and epiphytes, excluding micros and fungi, upon a single tree, forming such a tangle with the vines and lianas, that when the tree does come down, as every tree must sooner or later, it tears away with it so much that an acre of ground may be cleared. The author describes how impressive, and indeed terrifying, an experience it is to witness the crash of such a monarch. That country is so steep, that on a three-day trek they found only three level places, each of less than half an acre, and each devoted to a cinchona plantation.

Dr. Rusby noticed the remarkable habit of children eating pellets of dirt off the roads. This has been observed before, and, although no doubt it causes many intestinal complaints, it probably helps immunity. We read with surprise that the Indians can appreciate the beauty of a trogon and the bewitching melody of the lark. He tells us that toucans build their nests in holes in trees to sit upon their eggs, just like hornbills. Is there any correlation between this odd habit and the enormous development of beak? Surprising, too, is the generosity of a

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parrot, which spontaneously shared his sugar with a monkey. We share his thrill when he first sees a cock of the rock, or comes across that extraordinary bird the hoazin, though, as he does not mention the name, we are left to infer the names from his description. He describes a minute, transparent catfish, only three-quarters of an inch long, in the same genus with monsters of 300 lb.; he was able to observe it strike with its pectoral fin, which is poisonous, to disable its prey. The wealth of South American rivers in this group is remarkable.

The author gives a very interesting account of the cinchona and coca plants, and the romance of their culture and commerce. Of the former, the two chief species out of the fifty known are extinct, and he tells us of the striking beauty of the tree. The coca shrub is what is known as a "garden species," for it is unknown in the wild state. He tells us that the South Americans resent intensely the loss of their cinchona and rubber monopolies, but it is clearly Nemesis for the appalling abuses which they permitted. He points out, too, that peonage is not an unmixed evil, as labour is so valuable that employers treat their peon with a certain humanity. He bears witness to the intensity of the old hatred between Chile and Peru, and supplies interesting evidence of the tentacles of German imperialism even fifty years ago, when it was dreaming of the eventual acquisition of South America.

There is, too, abundance of human interest, apart from the inevitable dangers and hardships, with many a drama and many a tragedy. The story of the Texas killer, his companion, reads like a film caption. "For God's sake, doc, don't kill your first man!" Boon May warns him. It appears it becomes a habit, for the speaker had over 65 to his credit. This chivalrous frontiersman was an invaluable companion to the author. Yet at one moment, when all their nerves were strained to breaking point, a situation arose of dramatic intensity.

Our only complaints are that the maps are inadequate and the pictures too small, and that zoological names of animals are not given. On page 64 there is a slip in the captions, where a rhea is described as a red-legged goose and the paca and viscacha have exchanged places.

The Rise of the Celts. By HENRI HUBERT. (Kegan Paul, 16s.).

For more reasons than one this volume will be one of the most welcome to British archaeologists among the works of French contributors to the "History of Civilization" series. Its orientation toward the Celtic question differs somewhat from that to which we are accustomed in Great Britain. British students are exceptionally placed for the study of Celtic art and archaeology, literature and language, since the British Isles with Brittany are the only places in Europe in which any part of Celtic culture still survives as a living entity. But the broader aspects of the Celtic question, except in archaeology, escape adequate attention. M. Hubert's book, especially in the attention it gives to the racial history of the Celts in Central Europe, will do something to redress the balance.

The author worked on the writing of this book for many years. Even so, it was not finished at the time of his death. It has been completed by pious friends from lecture notes. This first volume—there are to be two—covers the history and traces the wanderings of the early Celts in Central Europe from Spain to the Baltic and from Greece to Ireland in the Bronze and early Iron Ages, closing just as the La Tène period is about to begin. The second volume will deal with the Celts of the La Tène period and will also review Celtic culture as a whole.

It will be seen that this first volume deals with a period which some archaeologists are disposed not to allow as Celtic at all. Whether or not that view be accepted, it must be admitted that knowledge of this period is essential to a full understanding of the Celtic period proper. From one point of view, that of European prehistory as a whole, the difference is immaterial, especially when it leads to the production of a book as valuable to the student as is this volume.

Man's Place Among the Anthropoids. By WILLIAM KING GREGORY. (Oxford University Press. 6s.).

Early Fore runners of Man. By W. LE GROS CLARK. (Ballière, Tindall & Cox. 15s.).

Those who wish to keep fully abreast of the latest developments in the study of man's descent cannot do better than study these two volumes concurrently: each illustrates and interprets the other. Neither, however, is a "popular" presentation of its case; but the arguments of both are so lucidly set forth as to need a minimum of technical equipment to appreciate their general bearing.

Professor Gregory, of the American Museum of Natural History, New York, has embodied in his book the substance of four lectures, delivered in Oxford and London in May and June, 1933. In these he surveyed the present position of our knowledge of the evolution of the human locomotor skeleton, the teeth and jaws, and the face and brain case of man, knowledge, indeed, to which he himself has been one of the foremost of recent contributors. Here he is concerned to show that the views recently put forward by Professor Wood Jones, which deny the close relationship of man and the anthropoids, and trace the human line of descent to a remote and extinct member of the primates, do not provide a rational explanation of the facts, as demonstrated by the comparative anatomical study of recent and extinct forms in the zoological scale. Professor Gregory shows that these can be interpreted only as evidence of phylogenetic affinity between man and the apes and that their resemblances cannot be explained away, as Professor Wood Jones would seek to explain them, as cases of "convergent evolution."

Professor Le Gros Clark works on a broader canvas. He argues that in order to appreciate the place of man in the evolutionary scale it is necessary that comparative study should not be confined to the anthropoids, but must be extended to take in the whole of the order of primates, both living and fossil. He has made a detailed anatomical study of the whole of the evidence afforded by fossil and existing primates, covering the tarsier and its ancestors, lemurs, monkeys, anthropoids, and man. As a result, he is able to suggest lines for an evolutionary chart, or series of charts, which express the phylogenetic relationship of the various members of the order and their relative date of appearance in the evolutionary scale. Professor Clark, however, shows no hesitation in pointing out to his readers the imperfect character of the record and the risks his conclusions run in the event of the discovery of fossil forms at present unknown.

Professor Clark's book is a valuable and strikingly original contribution to our knowledge of the primates and their inter-relations. But it must also be pointed out that not only is it a pioneer study in the elucidation of a specific problem, but it also has an important bearing on general biological theory and method. This aspect, however, cannot be discussed adequately without a detailed review of evidence and argument which is not possible here.

The Chinese, their History and Culture. By KENNETH STOTT LATOURETTE. Two Vols. (Macmillan. 30s.).

China has a population computed to be well over four hundred millions; her history claims an antiquity extending well into the third millennium B.C.; and she had attained an advanced civilization when the greater part of Western Europe was still in the tribal stage. It may, therefore, be a matter of some legitimate surprise that a country of such unquestionable importance and interest to the rest of the world, if only by weight of numbers, should be so little known. A hint of the explanation is perhaps afforded by Chinese art. The appeal of Chinese art is not immediate; but if at first it may seem bizarre, and even a trifle grotesque, when once its canons have been assimilated, it has a forcefulness combined with charm that gives an æsthetic satisfaction to be found in no other art. In the same way, Chinese history and civilization can be appreciated as vital factors in the world's history only when initial difficulties have been overcome and its alien qualities have been familiarized.

Mr. Latourette's book may not dispel the feeling that there is something alien and remote in Chinese history and culture, but it will serve to make that something comprehensible. It falls into two parts: in the first the author deals with Chinese history, which needless to say he does not carry back as authentic to the date claimed by the Chinese annalists; in his second volume he deals with the more important manifestations of Chinese life and culture, religion, art, the drama, social organization, science, industries and the like, in relation to their effect in moulding Chinese history. It has not been possible for him in the space available to deal with all these subjects in detail, but the treatment is adequate for the purposes of the reader for whom the book is intended. Bibliographies provide a guide to further study.

This, however, does not exhaust the scope of the book, nor, possibly, indicate its chief value. Many readers will feel that this lies in the author's acute observation of present day conditions, and of the modifications in the Chinese life and outlook which are taking place under the pressure of economic factors and the contacts with western political thought and industrial conditions. The author's conclusions as to present tendencies deserve careful attention; they should be widely known. His forecasts may prove to be at fault; but they deserve consideration. The western world cannot afford to ignore China in its future outlook. Whichever way China may move, four hundred millions of people, who are on Chinese showing increasing in numbers rapidly every year, must tell in world changes. Economic conditions preclude that China should remain immobile for very much longer.

Tents in Mongolia. By HENNING HASLUND. (Kegan Paul. 15s.).

A party of Danes, led by Dr. C. E. Krebs, of Red Cross fame, started a pioneering colony in a remote corner of Mongolia. One of the party has given us here a cheerful, entertaining and interesting account of this fascinating region and people.

Mr. Haslund is a good observer. He records, with ample detail, especially about the Mongols, whom he learnt to respect. He found their ideals very like our own and, with them, felt little sympathy either with Chinese or Russians. The Mongols are a martial folk, as becomes nomads with their wealth in herds, and that means that they, like the Kazaks or Kirghiz, have a sound idea of the value of breeding and pride of race. They feel contempt for the commercialism of the Chinese and, above all, for the

Chino-Mongol half-breeds, the *balder*. The Mongols are familiar with dinosaur bones, which they call *tenggerin losang yasa*, Bones of the Dragons of Heaven, and used them for medicine. They are rich in songs, mainly about horses, and have a strong artistic sense. The book gives some striking examples of their art, of which the vigorous dust jacket is a sample.

The author gives us glimpses of the Soyots, a little known tribe approaching extinction, to whom he attributes Turki relationship. He was fortunate in being allowed to witness a ceremony of Shamanism, the fundamental belief of northern Asia, which survives, though in masked form, through the superimposed religions of Islam, Buddhism and Christianity.

Without being a professed naturalist, the author gives a fair picture of the fauna and flora of the region, and the errors are presumably faults of translation. For instance, the statement that eagles rob eggs (page 148) or eat carrion (page 58) can probably be so explained, as also the misuse of the name of kangaroo rat (properly an Australian marsupial), where jerboa is clearly meant, and the African sand-rat for gerbille (page 57).

Twelve Centuries of Rome. By G. P. BAKER. Bell. (16s.).

Mr. Baker needs no introduction as a student of Roman history. He is to be congratulated on producing a book which presents so vast (and often so ponderous) a subject in such an absorbing way. A critic has said that Mr. Baker has the faculty of bringing to life everything and everybody he touches, and there could be no more apt recommendation for this fascinating book. He takes a sweeping view of twelve hundred momentous years, from the first ploughing of the boundaries of the city to its final decline and fall, and while his canvas is full of detail, he maintains a perfect sense of proportion throughout the history. If Mr. Baker produces nothing new, it can fairly be said that he presents his subject in a new and refreshing light. He is wise to have selected his portraits from contemporary coins, by far the most authentic source; and the chronological tables and diagrams which embody the formal side of the story are a welcome feature of the book.

The Charm of Ireland. By STEPHEN GWYNN. (Harrap. 7s. 6d.).

It is curious that, while an increasing number of people are travelling abroad every year, it is still more usual to go to the Continent before exploring the British Isles, and particularly Ireland. Though Mr. Gwynn's book first appeared some years ago as one of the "Kitbag Travel Books," it has been brought up to date by an additional chapter which incorporates suggestions made since it was first written and gives some account of recent developments. There is a description of the Shannon electricity scheme which was dealt with in its early stages in *Discovery* and has since made much progress. There are a number of reproductions of paintings by Irish artists, as well as photographs.

Mr. Gwynn writes as an Irishman who knows and loves his country whether it be Free State or Northern Ireland. He knows its charms and he makes them irresistible. He writes for tourists (but not as a tourist), for archaeologists and historians and for fishermen, all of whom will find their own point of approach noted, all of whom will find it difficult to skip over the other's fancy. The book has plenty of practical information as to hotels and is arranged in such a way as to divide the country into seven districts for purposes of exploration. Altogether it is an admirable guide for those planning an Irish holiday.

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